Summer 2010

An ethnographic investigation of the process of change in students' environmental identity and pro-environmental behavior in an Environmental Science course

Erica N. Blatt
University of New Hampshire, Durham

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121 - 129

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UMI
AN ETHNOGRAPHIC INVESTIGATION OF THE
PROCESS OF CHANGE IN STUDENTS’ ENVIRONMENTAL
IDENTITY AND PRO-ENVIRONMENTAL BEHAVIOR
IN AN ENVIRONMENTAL SCIENCE COURSE

BY

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DISSERTATION

Submitted to the University of New Hampshire
In Partial Fulfillment of
The Requirements for the Degree of

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in
Education

August, 2010
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# TABLE OF CONTENTS

**ACKNOWLEDGEMENTS** ....................................................... iv  
**LIST OF TABLES** ................................................................. x  
**LIST OF FIGURES** ................................................................. xi  
**ABSTRACT** ...................................................................... xii  

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1 THE CONCEPTUAL FRAMEWORK</td>
<td>7</td>
</tr>
<tr>
<td>Environmental Education Research: The Need for a Shift in Approach</td>
<td>7</td>
</tr>
<tr>
<td>The Research on Environmental Identity</td>
<td>31</td>
</tr>
<tr>
<td>Symbolic Interactionist Theories of Emotion</td>
<td>38</td>
</tr>
<tr>
<td>The Role of Critical Reflection</td>
<td>46</td>
</tr>
<tr>
<td>The Process of Change</td>
<td>49</td>
</tr>
<tr>
<td>Summary of Conceptual Framework</td>
<td>56</td>
</tr>
<tr>
<td>2 METHODOLOGY</td>
<td>50</td>
</tr>
<tr>
<td>Rationale for Research Methodology</td>
<td>58</td>
</tr>
<tr>
<td>Sources of Data</td>
<td>59</td>
</tr>
<tr>
<td>Research Setting</td>
<td>81</td>
</tr>
<tr>
<td>Participant Involvement</td>
<td>82</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>84</td>
</tr>
<tr>
<td>Managing Bias</td>
<td>95</td>
</tr>
<tr>
<td>An Environmentally Responsible Person</td>
<td>96</td>
</tr>
<tr>
<td>Limitations of the Research</td>
<td>108</td>
</tr>
<tr>
<td>The Researcher’s Thoughts on Cogenerative Dialogue</td>
<td>119</td>
</tr>
<tr>
<td>The Role of the Researcher</td>
<td>121</td>
</tr>
<tr>
<td>Ethical Issues</td>
<td>134</td>
</tr>
</tbody>
</table>
# Table of Contents

3 THE PROCESS OF CHANGE IN STUDENTS' ENVIRONMENTAL IDENTITY AND PRO-ENVIRONMENTAL BEHAVIORS DURING AN ENVIRONMENTAL SCIENCE COURSE .......................... 137

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>138</td>
</tr>
<tr>
<td>Literature Review</td>
<td>140</td>
</tr>
<tr>
<td>Theoretical Framework</td>
<td>143</td>
</tr>
<tr>
<td>Results</td>
<td>160</td>
</tr>
<tr>
<td>Discussion and Implications</td>
<td>183</td>
</tr>
<tr>
<td>Conclusion</td>
<td>194</td>
</tr>
</tbody>
</table>

4 A SOCIOCULTURAL ANALYSIS OF ACTIVITY IN AN ENVIRONMENTAL SCIENCE COURSE ........................................ 195

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>196</td>
</tr>
<tr>
<td>Literature Review</td>
<td>197</td>
</tr>
<tr>
<td>Theoretical Framework</td>
<td>201</td>
</tr>
<tr>
<td>Methodology</td>
<td>212</td>
</tr>
<tr>
<td>Results</td>
<td>218</td>
</tr>
<tr>
<td>Discussion and Implications</td>
<td>257</td>
</tr>
</tbody>
</table>

5 AN INVESTIGATION OF THE GOALS FOR THE ENVIRONMENTAL SCIENCE COURSE FROM THE TEACHER’S AND STUDENTS’ PERSPECTIVES ........................................ 269

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>270</td>
</tr>
<tr>
<td>Literature Review</td>
<td>272</td>
</tr>
<tr>
<td>Methodology</td>
<td>289</td>
</tr>
<tr>
<td>Discussion and Implications</td>
<td>323</td>
</tr>
</tbody>
</table>

6 THE SYNTHESIS .................................................. 335

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Role of Environmental Identity</td>
<td>336</td>
</tr>
<tr>
<td>The Role of Emotion</td>
<td>342</td>
</tr>
<tr>
<td>The Role of Empowerment</td>
<td>346</td>
</tr>
<tr>
<td>The Role of Presenting a Balanced Approach</td>
<td>350</td>
</tr>
<tr>
<td>The Role of Behavior Change</td>
<td>355</td>
</tr>
<tr>
<td>The Role of Cultural Tension</td>
<td>360</td>
</tr>
<tr>
<td>Conclusion</td>
<td>368</td>
</tr>
<tr>
<td>CHAPTER</td>
<td>PAGE</td>
</tr>
<tr>
<td>-----------------</td>
<td>------</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>373</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>383</td>
</tr>
<tr>
<td>Appendix A: Pilot Study</td>
<td>384</td>
</tr>
<tr>
<td>Appendix B: IRB Documentation</td>
<td>419</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>110</td>
</tr>
<tr>
<td>2</td>
<td>219</td>
</tr>
<tr>
<td>3</td>
<td>219</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Participants and Group Meetings</td>
</tr>
<tr>
<td>2</td>
<td>Summary of the Seven Activities</td>
</tr>
<tr>
<td>3</td>
<td>Students’ Ranking of Activities</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>153</td>
</tr>
<tr>
<td>2</td>
<td>186</td>
</tr>
<tr>
<td>3</td>
<td>297</td>
</tr>
<tr>
<td>4</td>
<td>298</td>
</tr>
</tbody>
</table>

1. Environmental Identity
2. The Process of Change for Students in the Environmental Science Elective Course
3. Heise’s Affect Control Theory
4. Teacher’s Goals for Environmental Science Course
ABSTRACT

AN ETHNOGRAPHIC INVESTIGATION OF THE PROCESS OF CHANGE IN STUDENTS' ENVIRONMENTAL IDENTITY AND PRO-ENVIRONMENTAL BEHAVIOR IN AN ENVIRONMENTAL SCIENCE COURSE

by

Erica N. Blatt

University of New Hampshire, September 2010

In recent years, the Environmental Science course has become increasingly integrated into the high school curriculum as a component of the core curriculum, an AP course, or as an elective (Edelson, 2007); however, little research has been conducted to evaluate the course’s effectiveness in developing students’ understanding of their relationship with the environment (Zelezny, 1999). Therefore, this ethnographic study at a public high school in the Northeastern United States focuses on the teacher’s goals for the Environmental Science course, how students respond to the enactment of these objectives during activities in the classroom, and how the class impacts students’ views of their relationship with the environment and their pro-environmental behavior. A sociocultural approach is utilized to explore how students’ environmental identities, their interactions with the course content, as well as their social interactions affect their experiences in the Environmental Science classroom. The study’s conceptual framework is based upon Kempton and Holland’s (2003) stages of environmental identity development, as well as symbolic interactionist theories of emotion. The participants in
this study are an Environmental Science teacher and the 10-12th grade students (N=17) in her semester-long elective, "Environmental Science." The researcher collected data for a period of six months during the spring semester of 2009, attending class on a daily basis. Data was collected through participant observation, videotaping, interviews, cogenerative dialogues, and various surveys. The objectives for the Environmental Science course explored in this research include the role of science content knowledge and critical thinking as students are exposed to new environmental information; developing students’ emotional connection with environmental issues; influencing students’ environmental behavior; and empowering students to feel that they can make a difference through their own actions. Through presentation of the students’ reactions to their experiences in the classroom, the results of this study provide new information for educators working with students to help them define their relationship with the environment by illuminating the elements of various activities that are effective for individual students, as well as factors that may be prohibitive. Findings therefore provide insight for science teachers designing and incorporating environmental activities into the high school curriculum.
"The best journeys answer questions that in the beginning you didn’t even think to ask."

- Documentary Film 180° South

"Given a chance, a child will bring the confusion of the world to the woods, wash it in the creek, turn it over to see what lives on the unseen side of that confusion."

- Richard Louv, Last Child in the Woods
INTRODUCTION

STATEMENT AND SIGNIFICANCE OF THE RESEARCH

The current approach to research in the field of environmental education is centered on the definition of environmental literacy which was established in 1975, as follows:

to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current environmental problems and the prevention of new ones. (The Belgrade Charter: A Global Framework for Environmental Education, 1975)

In the decades thereafter, the environmental education movement has grown in both the formal and non-formal sectors with the aim of teaching environmental knowledge, skills, attitudes, and behaviors. However, since these goals are only loosely defined in the Belgrade Charter, the programs that have been created are focused upon varying aspects of environmental literacy. In response, researchers in the field of environmental education have focused their research, up until the present, on assessing the effectiveness of programs in teaching environmental knowledge, skills, attitudes, and behaviors, and the relationship among these factors. The majority of studies to date have been quantitative, using surveys designed to measure the above constructs (Bogner & Wiseman, 1999; Culen & Volk, 2000; Dunlap, Van Liere, Mertig, & Jones, 2000; Hsu, 2004; Hwang, Kim, & Jeng, 2000; Kuhlemeier, Bergh, & Lagerweij, 1999; Manoli & Johnson, 2007; Meinhold & Malkus, 2005; Walsh-Daneshmandi & MacLachlan, 2006).
In reviewing these studies in the first section of Chapter 1: The Conceptual Framework entitled “Environmental Education Research: The Need for a Shift in Approach,” I emphasize what has been learned from these studies, as well as what has been overlooked by utilizing this approach to research. By using a reductionist approach that breaks down the categories of environmental literacy into items on surveys, the majority of the studies provide information regarding the overall effectiveness of various programs and their innovations. However, I conclude that a further depth of understanding regarding how and why environmental programs are meeting their goals (or not) can be gained by exploring the social and cultural aspects of environmental education. This approach allows for the creation of a more holistic picture regarding how participants’ thoughts and feelings towards the environment, as well as aspects of their own identity, are changing as a result of participation in environmental education programs.

In the second section of the Conceptual Framework, I therefore argue for a shift from the present research approach to one that is focused on the social and cultural factors affecting learning in environmental education settings. The sociocultural learning theory of Lev Vygotsky and Barbara Rogoff will be introduced, as well as a framework from the field of cultural sociology (Sewell, 1999) for viewing the concept of culture. Gathering data regarding the social interactions and cultural background of students provides information and depth regarding the process of learning as students move towards a greater environmental consciousness. In the third section of the Conceptual Framework, several studies are discussed that have explored the development of environmental identity. Since the majority of these studies are conducted with populations of adult environmental activists, this leads to a call for studies involving
environmental identity development in the adolescent population. At the end of this section, two studies by Horwitz (1996) and Kals et al. (1999) are highlighted whose findings suggest the important role emotion plays in developing one’s connection with the environment.

The fourth section of the Conceptual Framework, therefore, discusses a framework for considering the relation between identity and emotion that has been examined in the field of sociology. The identity theory of emotion of Stryker (2004) and McCall and Simmons (1978) are described, in addition to Heise’s affect theory of emotion (cited in Turner & Stets, 2005), both of which are useful in interpreting the students’ emotional responses to activities experienced in the Environmental Science course. In the final section of Chapter 1, the discussion focuses on several ways in which a student may change aspects of her environmental identity and pro-environmental behavior as a result of various experiences in the classroom. At the end of the section, I discuss transformative learning theory, which originated in the analysis of adult learning processes as learners underwent a process of critical reflection of their underlying values and assumptions (Mezirow, 1997), and discuss its implications for this research project. By focusing on how sociocultural factors are interacting with elements of identity, emotion, and critical reflection, this study utilizes a unique framework for examining how individual’s develop, define, and change their understanding of their relationship with the environment and pro-environmental behavior.

Chapter 2: The Methodology provides an overview of the setting and participants in this research study, the forms of data collection, and a discussion of the methods of data analysis. Following this, the biases of the researcher and the limitations of the study
are discussed, in addition to a final section discussing the role of the researcher in the study. Regarding the setting for this dissertation project, the reasons for the selection of a high school Environmental Science class are twofold. First, of all the studies conducted regarding environmental education, few have evaluated formal programs in American schools or have attempted to determine what should be included in environmental education programs in our schools to bring about the desired outcomes (Zelezny, 1999). Second, there are a growing number of Environmental Science elective courses at the high school level that have been largely unevaluated, and in which a larger number each year of our public school students are engaged (Edelson, 2007). Therefore, the public high school Environmental Science elective course has been chosen in order to explore the process of change in students’ environmental identity and associated behaviors.

Since the major goal of this research is to explore the elements of identity, emotion, and critical reflection that are influencing students’ learning in an Environmental Science classroom through a sociocultural approach, a qualitative ethnographic methodology has been chosen that allows for analysis at the individual and collective levels in the context of activity in the classroom setting. In Chapter 2, I thoroughly discuss the data collection processes of participant observation, interviews, videotape, and cogenerative dialogues that are the primary sources of data for this study. The process of cogenerative dialogue was developed in urban educational settings as a way to provide teachers and students with a social space to discuss their perspective on what it is like to “be in this classroom” in order to identify issues and co-generate possible solutions for resolving these issues (Martin, Milne, & Scantlebury, 2006). I offer a thorough description of how these small group dialogues have been utilized in
research and discuss their potential transformative role in the teaching and learning culture of the classroom. In addition, I address how these dialogues were used as a method of gathering data from both the students and the teacher in this study, as well as circumstantial limitations in the study setting that reduced the impact of the dialogues on the participants.

The chosen methodology is aimed at answering the following research question:

• How do we characterize the process of change in students’ environmental identity and pro-environmental behavior during an Environmental Science class?

This question can be broken down into the following four topical questions, which inform the processes of participant observation, formal interviewing, and cogenerative dialogue:

(1) How do students define their relationship with the environment and what behavior do students exhibit regarding the environment? What characteristics of their background have influenced these beliefs and actions?

(2) What is the teacher’s perceived and actual role in influencing her students’ understanding of their relationship with the environment and pro-environmental behavior?

(3) How are students’ environmental identity and pro-environmental behavior changed as a result of taking an environmental science class? What are the leverage points (activities, experiences, etc) for change? How does emotion, critical reflection, and other factors, such as self-efficacy, impact students during influential activities?

(4) How do the interactions of students with sociocultural structures of the classroom affect the (potential for) change in students’ environmental identity and associated behavior?

The results of this dissertation study are presented in Chapters 3, 4, and 5, each of which focuses upon a different theme illuminated during the process of data analysis. Chapter 3 focuses upon the process of change in students’ environmental identity and associated behaviors by highlighting the experiences of four students as they participated
in the Environmental Science course. This chapter focuses on the students’ environmental background, identity affirmation and disconfirmation, as well as ways in which the students changed their behavior during the semester. Chapter 4 is focused upon seven activities of the Environmental Science course and the sociocultural structures within the classroom that allowed or prohibited each activity from being a positive learning experience for the students in the classroom. The results presented in this chapter are aimed at providing recommendations for science teachers that are incorporating environmental activities within their curriculum. Chapter 5 involves a discussion of the teacher’s goals for the Environmental Science course, as well as students’ reactions to the enactment of these goals in the classroom. These results are informative in forwarding the conversation around what ought to be the aims of the Environmental Science course at the high school level.

The final chapter, Chapter 6: The Synthesis, presents an overview of the major findings from this study, in addition to a discussion of the implications both for the field of environmental and science education research, and directly for science teachers in the classroom. The hope is that this research will be useful to environmental educators as they attempt to bring about the ultimate goal of helping students define their environmental identity and act with an environmental consciousness. Additionally, this research is aimed at beginning a shift beyond the environmental literacy approach into a new emphasis for environmental education research, an emphasis that places a focus on reflective thought and emotion as students’ gain an understanding of both themselves and their environment.
CHAPTER 1

THE CONCEPTUAL FRAMEWORK

Environmental Education Research: The Need for a Shift in Approach

Let us return for a moment to the 1970s, a decade which brought a new awareness of environmental issues that stirred discussion of the need for widespread environmental literacy to be brought about by environmental education. Prior to this, environmental education was encouraged by the conservation movement, whose goal was to help the public better understand the importance of natural resources to our society; however, the incorporation of environmental issues into science classes was uncommon and had little intention of restructuring attitudes or encouraging social action (Stevenson, 2007). The environmental literacy movement redefined the goals of environmental education in the Belgrade Charter, which was established at the International Workshop on Environmental Education held in Belgrade, Yugoslavia, October 13-22, 1975 (UNESCO, 2007). That charter set the goal as follows: “to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current environmental problems and the prevention of new ones” ("The Belgrade Charter: A Global Framework for Environmental Education," 1975). The workshop was a defining event of the UNESCO-UNEP International Environmental Education Programme (IEEP), whose goal was to lay the framework for an international environmental effort in environmental education which would aim to
raise awareness and encourage environmental responsibility in nations around the world and called for a reassessment of national and regional priorities towards a system that takes into account humanity's impact on the environment ("The Belgrade Charter: A Global Framework for Environmental Education," 1975). The establishment of the goal set forth in the Belgrade Charter was a large step in the acknowledgement of the need for a worldwide effort to make environmental education a priority. However, while its goals are lofty, words like "attitudes" and "knowledge" were defined only briefly, leaving it to organizations around the world to fill in the meaning.

As a result of the lack of standard definitions regarding what is to be included in environmental education programs, the programs that have been developed in recent decades have incorporated various aspects of knowledge, skills, attitudes, and behaviors with specific goals being determined by educators running individual programs. Accordingly, in keeping with the environmental literacy approach, researchers in the field of environmental education have focused their research on assessing the effectiveness of programs at teaching environmental knowledge, attitudes, and behaviors; and they have used primarily survey instruments in their research. Researchers have recently expanded the number of instruments used to measure how programs are affecting these factors (Bogner & Wiseman, 1999; Dunlap, Van Liere, Mertig, & Jones, 2000; Walsh-Daneshmandi & MacLachlan, 2006), in addition to focusing on analysis of the relationship between these factors (Hwang, Kim, & Jeng, 2000; Kuhlemeier, Bergh, & Lagerweij, 1999; Manoli & Johnson, 2007); and investigating how to best influence these factors (Hsu, 2004; Meinhold & Malkus, 2005). In this section I review several empirical studies that have been conducted and how they lay the framework for the research that
needs to occur now. In reviewing these studies, I emphasize what has been learned from these studies, as well as what has been overlooked. The first set of studies includes those that have examined the relationship between the various components of environmental literacy, while the second set of studies discussed includes those that have attempted to measure change over time in the above constructs as participants engage in environmental education programs. This critique leads into an argument in the following section for a shift from the present environmental literacy approach to research that utilizes an approach that explores the social and cultural factors affecting learning in environmental education settings.

Examining the Relationship of the Components of Environmental Literacy

The following set of studies examines the relations between environmental knowledge and the other components of environmental literacy as they attempt to explore the following questions: What is the relationship between teaching environmental knowledge and changing the environmental attitudes and behavior of students? Do we need to orient instruction towards the affective dimensions of environmental education in order to bring about attitudinal and behavioral changes, or will these “fall into place” after the relevant knowledge is learned? The majority of these studies show that there is a positive relationship between environmental knowledge and environmental attitudes and behaviors; however, the strength of this relationship is inconsistent between studies. The first study discussed below by Kuhlemeier et al. (1999) focuses on the environmental literacy constructs of knowledge, attitudes, and behavior, while the following two studies also include the factor of self-efficacy or locus of control in their investigations. A brief
summary of each of the studies is provided, followed by a critique of various aspects of the research instruments utilized and implications of the study results.

In the study by Kuhlemeier et al. (1999) entitled “Environmental Knowledge, Attitudes, and Behavior in Dutch Secondary Education,” 9,000 students from 206 high schools in the Netherlands were given surveys measuring their *environmental knowledge, attitudes, willingness to make personal sacrifices, and environmentally responsible behavior*. The knowledge component of their survey consisted of 80 items that were focused on environmental problems that had recently been in the media and educational material of the government. The researchers measured *environmental attitudes* with 20 Likert scale items, stating that their scale pertains to “the degree of environmental inclination (environment-mindedness), environmental concern, environmental indifference, and denial of environmental problems.” An example of one of two characteristic statements given is: "Owing to pollution of the environment, the world threatens to become unfit to live in for future generations" (Kuhlemeier, et al., 1999, p. 5). The behavior section of the survey used a self-report approach with an added note from Kuhlemeier, et al. pointing out that some questions in the behavior category, especially those related to household decisions, may have not been applicable to some participants because they were not in a decision-making position in regard to those tasks. Results of the study showed that while there was a positive correlation between environmental knowledge and the other variables, the relation was found to be extremely weak. The authors conclude that “Students who possessed a great deal of environmental knowledge hardly seemed to be distinguishable by attitudes and behavior from other students” (p. 10). A strong relationship did exist between environmental attitudes,
willingness to act, and behavior (Kuhlemeier et al., 1999). These results therefore suggest that environmental knowledge is not a strong predictor of students’ environmental attitudes or behavior.

While it is quite common in environmental education research to use self-reported behavior as a proxy measure for actual behavior, the behaviors reported may be quite different from students’ actual behaviors. However, the ability to assess actual behavior is virtually impossible in a survey study of this magnitude, and so these researchers used a self-report measure. This is problematic if self-reported behaviors do in fact differ from actual behavior for students in this study. However, no attempt is made by the researchers to investigate the correlation between self-reported and actual behavior. Despite this lack of clarity, the results are suggestive that environmental knowledge is not sufficient to predict students’ environmental attitudes and behaviors.

The next two studies discussed, in attempting to determine factors with strong relationships with environmental behaviors, also examine the role of self-efficacy (Meinhold & Malkus, 2005) and locus of control (Hwang et al., 2000). Jana Meinhold and Amy Malkus (2005) in their study entitled “Adolescent Environmental Behaviors – Can Knowledge, Attitudes, and Self-Efficacy Make a Difference?” investigated the connection between environmental knowledge, attitudes, self-efficacy, and environmentally-related behaviors. The study surveyed 848 adolescents, age 14-18 (of diverse ethnicities), from high achieving high schools in three large US cities. Bandura’s (1977, 1986) theory of self-efficacy states that an individual’s ability to effectively execute an action is influenced by her belief in her ability to do so. Meinhold and Malkus (2005) cite the definition of self-efficacy presented by Bandura as “the confidence that
individuals have in their ability to plan and execute a course of action and to accomplish a task or solve a problem” (p. 512). Meinhold and Malkus (2005) hypothesize that the likelihood of adolescents to partake in pro-environmental action may be related to their level of self-efficacy, in addition to knowledge and attitudes. Their survey consisted of 142 items designed to measure the dependent variable of environmentally responsible behavior and the other variables of environmental knowledge, attitudes, and self-efficacy to examine existing relationships. The results showed that higher pro-environmental attitudes can be correlated with higher pro-environmental behaviors, and that more environmental knowledge correlates with both of the above. These findings suggest that increasing environmental knowledge may lead to an increase in environmental attitudes and behavior (Meinhold & Malkus, 2005). The findings also show a statistically significant correlation between self-efficacy and adolescents’ environmental behavior, measured as a self-report in this study.

While the statistical analyses of Meinhold and Malkus were thorough, a notable weakness of the study is the questionable extent to which their survey provided an accurate measure of students’ environmental knowledge. The knowledge component, for example, consisted of 11 questions in a multiple choice format – given that students were taking this survey all over the United States, it is quite possible that by using only 11 questions the test may well have excluded environmental knowledge the students did have even though they may have not done well on these particular eleven items. This would be likely to occur since the breadth of environmental topics discussed and the relevance of these topics often differs in various parts of the country. In addition to the lack of thoroughness regarding the environmental knowledge items surveyed, the study
also fails to examine if there are other factors, such as students’ background, social interactions, etc, that need to combine with the knowledge to bring about change in students’ attitudes and behaviors. Perhaps more interestingly, however, the finding regarding the significant relationship between self-efficacy and environmental behavior suggests that more research is needed around the role of self-efficacy in environmental decision-making and action, which is one of the reasons for considering issues of self-efficacy and empowerment in the current study.

The construct of self-efficacy is linked to locus of control because of parallels regarding one’s perceived abilities to change or control one’s life (Meinhold & Malkus, 2005). In the study by Hwang, Kim, and Jeng (2000), the researchers create a rather complicated hypothesized causational model that shows the interrelationships between environmentally responsible behavior, environmental attitude, knowledge, locus of control, personal responsibility, and intention to act. They attempted to test its accuracy by giving a survey (5 point Likert scale) to 523 visitors to an urban forest trail in Korea. The authors claim that study results show that the hypothesized model of causal relationships is accurate, and that internal locus of control was the most significant factor affecting environmental attitude and intention to act. Locus of control is defined as “an individual’s belief in whether or not he or she has the ability to bring about change through his or her own behavior” (p. 20). An internal locus of control leads to the expectation that one’s own activities will bring about change, while an external locus of control refers to the belief that changes happen by chance or by the actions of powerful “others.” Due to the finding of the importance of locus of control, the authors conclude that environmental education programs should focus on establishing a strong internal
locus of control in their participants by encouraging people to make their own decisions, evaluate solutions, and act upon these decisions (Hwang et al., 2000). While these are worthy goals for environmental education programs, it is questionable the extent to which this study proved causality, since the relationships between factors shown in the results are correlation coefficients. Correlation coefficients only prove a correlational, not a causal, relationship.

In addition to the low reliability score of Hwang et al.’s (2000) survey, there are serious concerns regarding the validity of the items used to measure the construct of environmental attitude. The survey measures environmental attitude with only three statements: (1) “Forest is important because it is the origin of life,” (2) “When I see the forest, I feel like relaxing there,” and (3) “I like to reside in forested areas” (Hwang et al., 2000). If a person agreed with these statements, then they were considered to have a positive environmental attitude. There are several problems with these statements including the scientific basis of the first statement, and the possible Utilitarian interpretation of the last two statements; therefore, it is questionable to what extent the use of this survey actually gives evidence of an environmental attitude. Although the findings in this study are questionable in many regards, their findings do suggest, like the Meinhold and Malkus (2005) above, that there may be a significant role for internal locus of control in encouraging people to act upon their environmental decisions.

Despite the limitations of the above studies, they are useful in providing a base of research that suggests that while the teaching of knowledge in environmental education settings may have a role in affecting students’ environmental attitudes and behaviors, knowledge is not sufficient in explaining differences in students’ environmental attitudes.
and behaviors. Additionally, the latter two studies have begun to stretch beyond the limits of the *knowledge*, *attitude*, and *behavior* constructs, in attempting to define what other factors may be at work, besides knowledge, in affecting environmental attitudes and behavior. The studies of Meinhold and Malkus (2005) and Hwang et al. (2000) have identified another factor, related to self-efficacy and locus of control, which may play a significant role in affecting environmentally-related behaviors. However, due to the use of questionable surveys and failure to recognize what is needed to establish causational relationships, the relation between these factors remains unclear. It is also uncertain to what extent it is helpful to continue attempting to measure the broad constructs of ‘knowledge,’ ‘attitudes,’ and ‘behaviors’ without further investigation into more contextual questions. If we are to have a research base adequate for the task of underwriting conceptualization of environmental education programs, equally important is the conclusion that more research is needed regarding factors other than knowledge that may be important in influencing the environmental learning of students.

**Evaluation of Environmental Education Programs**

While the above studies provide an estimation of the status of participants’ environmental knowledge, attitudes, and behavior at a given point in time, they do not consider change over time as students engage in a particular curriculum or coursework. In contrast, the following studies investigated change in environmental attitudes and behaviors over time as students participated in a specific environmental course. In recent years, environmental courses and programs have begun to take a more direct approach towards affecting students’ environmental attitudes and behaviors, rather than assuming that knowledge will translate into change in these other factors as well. Some recent
studies, of which a sampling is critiqued below, have shown that programs that explicitly teach positive environmental attitudes and behaviors have been effective at bringing about change in students.

The following studies have been chosen for discussion because they take place in formal educational settings, which is also the focus of this dissertation study, and they represent a variety of methodologies whose strengths and weaknesses have contributed to the design of this research project. The first studies described use the type of quantitative surveys discussed above. Unfortunately, some of the same critiques of the above studies in surveying the constructs of environmental knowledge, attitude, and behaviors apply here as well, and so those critiques are not focused upon in this section. The next set of studies move toward a mixed methods approach with a qualitative interviewing component. The last two studies discussed, Sosu and McWilliam (2007) and Blatt and Abrams (2007), have been particularly informative in developing the design of this dissertation study by demonstrating the value that qualitative methodologies can add to the environmental education research field by providing information regarding the meaning and context experienced by participants in learning situations.

The first two articles analyze a teaching approach called the “Issue investigation-evaluation and action skills training model” (Culen & Volk, 2000; Hsu, 2004). This model emphasizes environmental knowledge and awareness, but also has students participate in their own environmental issue investigation and evaluation, and has a section focused on environmental action strategies. The course in the Hsu study also had a section entitled the “Hope and Empowerment Unit.” Culen and Volk (2000) study how this program is implemented with 7th and 8th graders, while Hsu (2004) evaluates this
program as it is applied in a college environmental science course in Taiwan. Both studies used a quantitative survey method giving pre- and post-tests to experimental and control groups of students, measuring varying factors such as responsible environmental behavior, environmental attitudes, locus of control, intention to act (Hsu, 2004, only), perceived knowledge of and skills in using environmental action strategies (Culen & Volk, 2000; Hsu, 2004). Both studies found significant positive increases in the majority of these categories for the experimental classes that had received the “treatment,” suggesting that issue-based teaching is a useful strategy when trying to affect environmental attitudes and behaviors. A major critique of these studies addresses an existing tension between the individual and class levels of analysis. The teaching strategies seemed to be aimed at affecting change in the individual (utilizing a self-directed investigation and evaluation), and the pre- and post-tests are given individually, yet the results are only analyzed at the class level. Therefore, differences between individuals are not analyzed or further explored, which could lead to helpful information regarding what actually influenced these students and how they experienced the process of change. The individuals in the studies are viewed as influenced solely by the “treatment” in the study. While these results are useful in documenting a successful teaching strategy in affecting students’ environmental attitudes and behaviors, the contextual factors that may have influenced each student are not considered. In statistical terms, the researchers have not ruled out alternative hypotheses that could have simultaneously been influencing the outcome. The current dissertation study therefore seeks to build upon these results by also looking at change over time in an Environmental Science course, while exploring in further depth how various components of the course
are affecting individual student’s thoughts, emotions, and identity regarding the environment.

In another study conducted at the University of Arizona, the researcher was investigating the effects of an environmental program on environmental perceptions and actions (Manoli & Johnson, 2007). Here, the term environmental perceptions is taken from Bogner and Wiseman (1999)’s study establishing the validity and reliability of the ENV environmental perception scale. Bogner and Wiseman (1999) equate environmental perception with environmental concern, and quote the German Governmental Expert Report, 1978, which defines environmental concern as “the reasonable view of our natural basis endangered by human beings, as well as, in combination with this view, the individual willingness to relieve this threat” (cited in Bogner & Wiseman, 1999, p. 139). In the Manoli and Johnson (2007) study, they are testing an environmental perception scale for use with children that incorporates a combination of items from the ENV scale and Dunlap et al.’s (2000) New Ecological Paradigm scale. Environmental action refers to a set of “environmentally friendly behaviors” that are encouraged during the program, without further specifics being given by Manoli and Johnson (2007).

The program called Earthkeepers is different from the studies discussed above in several ways. First, it is aimed towards 4th, 5th, and 6th graders, and it begins with a 3-day intensive immersion program at a site outside of school. The follow up to the program is carried out by the classroom teacher and by the individual students. Additionally, this study had both quantitative and qualitative components. For the quantitative component, students were given a pre- and post-test survey to “quantify” change in environmental perceptions and actions. The post-test was given 1 to 2 months after the immersion phase.
of the program. A year after the program’s completion, 18 students were interviewed (9 who had completed the program, and 9 who had not). The results of the interviews showed that the “completers” were more likely to be continuing their environmental actions than the “non-completers” and that the “completers” preferred to spend time outside more than the “non-completers.” The final results showed that pro-environmental perceptions after the program correlated with students carrying out more environmental actions (Manoli & Johnson, 2007).

The addition of a qualitative interviewing component to the study had much potential to add information that has been missing from many of the studies in this area of research, that is, regarding specific factors that are affecting change (or not) in individuals. The results reported based on these interviews, however, were disappointing because the interview questions did not probe for any more information than one might have acquired using more formal survey questions, and therefore did not get at the meaning of the experience of the students. The interview questions asked students about their environmental actions to confirm survey findings about whether they preferred to spend time outdoors or indoors, and their views about protecting the natural environment. Answers to the first two of these topics were reported only as quantitative percentages, while it was reported that students who completed the program “gave deeper, more elaborate reasoning” regarding protection of the natural environment (Manoli & Johnson, 2007) with no further elaboration. Even though these researchers claim to want to find out what is accounting for differences in “completers” and “non-completers,” they stop short of addressing the social and cultural influences affecting the students, such as family environmental beliefs, teacher encouragement, and opportunities for action, which
could have significantly impacted the results, but were not considered, or at least not reported. The results also do not provide findings regarding how particular activities and experiences influenced students. In order to further understand the factors accounting for whether or not change occurs in particular students as the result of environmental experiences, the current dissertation study uses a more robust qualitative approach to explore these sociocultural influences.

Next, I would like to discuss a study that differs from the above studies, in that it effectively uses a qualitative component. The authors, Edward Sosu and Angus McWilliam, call the study a “Mixed Method Approach to Education Research: A Case Study of Teacher Commitment to Environmental Education” (2007). This study utilizes a mixed methods approach with three phases, the first being an interview phase, where six primary school teachers were interviewed in order to establish questions for the second phase, which was a survey. The survey included 119 items and was distributed to 6th grade teachers at 500 schools, of which 182 were returned (36.4%). This data was used to generate an extremely complex model based on the much simpler Model of Environmental Education Commitment (MEEC), which had been previously established. The MEEC is a model demonstrating the relationship between teachers’ life experiences which influence beliefs, intentions, and ultimately commitment to environmental issues. The model developed by Sosu and McWilliam in this study showed that teacher perception of control over teaching Environmental Education had the highest influence on teacher commitment to Environmental Education. The third phase of the study was again qualitative, interviewing 7 teachers and using open coding to assess what teachers perceived to be the major barriers and the motivating factors to teaching Environmental
Education in their schools. The goal of this part of the study was to generate recommendations for changes in the school system that would improve teacher commitment to Environmental Education. The results of this phase showed that teachers perceived major barriers to EE to include (1) a restrictive curriculum, (2) limited resource availability (especially for new teachers), (3) lack of background knowledge, and (4) an emphasis on national testing (in Scotland). Motivating factors included the teachers’ feelings of responsibility for teaching about the environment, the enthusiasm of students and parents, and the teachers’ life experiences. Recommendations were aimed at counteracting the constraints described above, especially allowing teachers more flexibility with the curriculum structure and providing more EE training for teachers (Sosu & McWilliam, 2007).

One of Sosu and McWilliam’s arguments for a mixed methods study was based on the premise that teacher commitment to environmental education is a complex phenomenon, and “complexity cries out for mixed methods approaches” (Sosu & McWilliam, 2007). The authors advocate using a systems perspective to analyze this type of complex issue, rather than focusing on a single factor as other studies have done. They argue for a more holistic approach considering the different factors involved rather than the “piecemeal or ‘bits-and-pieces’ approach [which] is rooted in reductionist thinking and accounts for the poor results of educational reforms” (Sosu & McWilliam, 2007). The authors also claim that “behavior is understood only in the context of the larger whole or environment” (Sosu & McWilliam, 2007). This study clearly acknowledges the role of “life experiences” in influencing one’s environmental perceptions and behaviors. Unfortunately, however, the authors limit themselves in the
first two phases of the study to considering only the factors previously established by the MEEC, investigating the relationship between the MEEC’s six categories. In short, after acknowledging that the complexity exists, they still try to shape/reduce it to the form of this model. In the third phase, they move away from the model, using open-ended coding, and here is where, in my judgment, they get to the real complexity and depth of the issue. The use of interviews in the third phase of this research was particularly informative to the design of the current dissertation project, as the researchers were able to obtain useful information regarding affordances and obstacles to the teachers’ commitment to environmental education using this methodology. The focus of this dissertation research upon affordances and obstacles to change in students’ environmental identity and associated behavior explores a similar type of question to the Sosu and McWilliam (2007) study, which therefore suggests the benefit of including an interviewing component in the current study.

Of all the studies conducted regarding environmental education, few studies have been done evaluating formal programs in American high schools or attempting to determine what should be included in environmental education programs in our schools to bring about the desired outcomes (Zelezny, 1999). In an attempt to begin to address the absence of research in this area, a study was conducted involving Environmental Science teachers at high schools in New Hampshire. The aim was to investigate the teachers’ goals in the teaching of environmental literacy and to determine if and how they saw these goals being met in their classrooms (Blatt & Abrams, 2007). Six of the nine high school teachers interviewed stated that their personal goals for teaching Environmental Science included all four of the main categories of environmental literacy
including knowledge, skills, attitudes, and behavior. Of the other three teachers, two stated personal objectives in all categories except skills, whereas one referenced all categories except behavior. Interestingly, activities in the classrooms, with few exceptions, involved only the explicit teaching of environmental knowledge and skills. Several teachers stated that they did not explicitly teach environmental attitudes for fear of "being too preachy" with their students (Blatt & Abrams, 2007). The qualitative methodology utilized in this study provided useful information that offered insight into teachers' goals and struggles with implementing them, especially in the explicit incorporation of activities designed to influence students' attitudes and behaviors. However, the study did not collect first-hand evidence regarding the enacted curriculum in the classrooms that could substantiate the teachers' claims. Additionally, the study focused solely on teachers, and did not include interviews with students; therefore, it is unclear to what extent these courses are affecting change in students.

Thus, we have seen that a significant number of quantitative studies have been done to try to clarify the relationship between environmental knowledge, attitudes, and behaviors. From these studies we get the impression that while transmitting environmental knowledge may play a role in changing environmental attitudes and behavior, the exact nature of that knowledge, the manner in which it is transmitted or cultivated, the other factors with which it must combine, as well as the context in which it is learned, all require much more investigation. I have argued that if we are interested in establishing effective environmental education programs we need to move beyond the level of determining whether change is occurring, and begin to determine why change is (or is not) occurring, and what the specific stimuli are that influence the process of
change. I propose that a sociocultural approach to studying the process of change would better inform us about how environmental attitudes and behaviors are impacted. In addition, it is necessary to consider how various activities and interactions affect students' understanding of their relationship with the environment and pro-environmental behavior. What curriculum strategies are teachers using to effectively bring about change? To what extent are successful teachers explicitly discussing environmental attitudes and behaviors with their students, rather than focusing solely on knowledge? Are classroom activities and discussions aimed at influencing students cognitively, emotionally, or in some combination? What is the significance of teachers' backgrounds and students' backgrounds in affecting change in students? How important are trips outdoors or opportunities for social action in transforming students' attitudes and behaviors? A major goal of this dissertation study is therefore to go beyond showing that positive change is occurring, and move toward identification of the factors working together to bring about change in students. The hope is that Environmental Science teachers will utilize the results of this study to design and enact a more informed Environmental Science curriculum.

A Sociocultural Approach to Environmental Education Research

The above critique of the empirical studies suggests several reasons that research in the environmental education field would be enhanced by an approach informed by sociocultural learning theory. This theory posits that learning is embedded in social activities that occur as a child interacts with people, objects, and events in her environment, and suggests that we must examine the external social world of an individual in order to understand her development (Kublin, Wetherby, Crais, & Prizant,
1989). In this section, I first discuss the theories of Lev Vygotsky and Barbara Rogoff, upon whose work current conceptualizations of sociocultural theory depend. I then describe how cultural sociology (Sewell, 1999) informs the concept of culture utilized in this study, and follow with a discussion of how these theories frame this research.

Lev Vygotsky, who carried out his research in Russia in the early to mid-20th century, was one of the most influential researchers in bringing about a shift towards a sociocultural approach to learning. Throughout the phases of Vygotsky’s research he was trying to identify the relationship between speech, social interaction, and psychological development. He views this relationship as a process of internalization, where the individual is interacting in social settings and internalizing what she is learning from others through this interaction (Minick, 1987). Wertsch quotes Vygotsky describing this phenomenon of how “specific structures and processes of intramental functioning can be traced to their genetic [developmental] precursors on the intermental plane” (Wertsch, 1991, p. 27). Vygotsky believed that cognitive learning, which is internalized by an individual, is a result of social interactions and discourse between individuals. Another significant contribution to the field of learning theory was shifting the unit of analysis from the individual to activity. Giving full credit to Vygotsky for initiating this shift, Barbara Rogoff suggests that this has allowed for a new focus on learners as active participants in socially constituted practices (Rogoff, 1990).

Barbara Rogoff cites Vygotsky as one of the founders of this theory, but Rogoff pushes Vygotsky’s ideas to another level by suggesting the non-existence of the internal/external dichotomy of the individual and social interaction. She criticizes the term “internalization” because it suggests a separation of the individual (internal) from
her social context (external), and assumes the “acquisition” of concepts which can be stored in the mind. Instead, Rogoff prefers the term *participatory appropriation*, which she describes as “the process by which individuals transform their understanding of and responsibility for activities through their own participation” (Rogoff, 1990, p. 150).

*Appropriation* is focused on the active changes, which could be either in the rational or non-rational realm, that occur in an individual while they are participating in an activity, preparing them for involvement in other similar events in the future. Interestingly, years earlier, John Dewey described a very similar process as “educative teaching” by which a young person participates in the social activities of her group and shares in the thoughts and emotions surrounding these activities. To quote Dewey:

> A being connected with other beings cannot perform his own activities without taking the activities of others into account. For they are the indispensable conditions of the realization of his tendencies. When he moves he stirs them and reciprocally. We might as well try to imagine a business man doing business, buying and selling, all by himself, as to conceive it possible to define the activities of an individual in terms of his isolated actions. (Dewey, 1916, p. 14)

Therefore, Dewey seems to share the conviction with Rogoff that the individual is indistinguishable from the sociocultural context of her learning.

The sociocultural framework used in this study is that established by Vygotsky and Rogoff, which places *activity* at the center of all interaction as the *unit of analysis*. Rather than focusing upon the individuals in the class as isolated entities, this means that, as suggested by Tobin (2007), the researcher views “all individuals as dialectically interconnected with the collective, and each presupposes the other (i.e., individual/collective). This implies that no individual can act independently of the collective and individual actions become material resources that structure collective
agency” (Tobin, 2007, p. 7). This study therefore investigates the process of learning among “interconnected” individuals as they participate in classroom activities. The activity is situated in the sociocultural context of the classroom and the participants’ lives outside the classroom (both past and present). By focusing on activity, this allows the researcher to explore interactions on multiple levels, including those layers of interaction which are visible through observation, and also those layers involving participants’ sociocultural background and influences that are explored more deeply.

Sociocultural theory has grown in influence in the field of science education, and many researchers are now embracing this lens in their research. For example, Tobin argues that the complexity of the science classroom requires the researcher to adopt a sociocultural focus “in terms of teacher and student beliefs about teaching and learning, modes of knowing science, the influence of peers and the teacher on learning, within class and school influences, and gender, social class and ethnicity as factors associated with learning science” (cited in Cobern, 1996, p. 582). As noted above in the critique of recent empirical studies, investigation of the sociocultural influences affecting the environmental attitudes and behaviors of students was consistently absent. By using sociocultural learning theory to inform this research project, it ensures that these factors remain a focus of interest, thereby beginning the process of filling in a significant gap in environmental education research.

Culture, Fields, Structure, and Agency

Consistent with sociocultural learning theory, a view of culture from the field of sociology is utilized in the current research. Culture is defined in the field of cultural sociology (Sewell, 1999) as “as a weakly bound system of schema and practices that
interact in a dialectical relation with each other, material resources, and agency (the power to act and appropriate resources to meet one's goals)” (LaVan, 2004, p. 62). The structures operating in a given setting represent a combination of the schema, or ideologies of the participants, as well as the material and symbolic resources being employed within that setting. These structural factors are interconnected with agency in determining what practices are enacted (Martin, 2004). Describing the dialectical relationship between structures and agency, Loman (2005) states that “the dispositions to act, as a result of a person’s habitus depend on the capital the individual holds in the field of the classroom” (p. 174). Thus, practices can be said to operate within fields (structured places where participants enact culture), such as an Environmental Science classroom, whose boundaries are “both weak and porous” allowing cultures from other fields, such as home, to be enacted within the classroom (Loman, 2005).

Within the field of the Environmental Science classroom, this study investigates the structures that both afford and prohibit learning from occurring. Several sociocultural structures that have been hypothesized to influence learning are focused upon in this research, including social relationships, adolescent identity, cultural background, and current cultural influences. The first of these influences is that of peer-peer relationships, as well as teacher-student relationships. Peers are likely to have a strong influence on each other’s engagement during class, since developmentally teenagers are at a stage where their peers exhibit greater influence. It has been suggested that a teenager’s worldview is rooted in the “public persona” (how they are viewed by others), more so than other age groups, and as a result “motivating forces for environmental consciousness may be different in the adolescent from those salient for other age groups” (Walsh-
Daneshmandi & MacLachlan, 2006). Therefore, student interactions during class are carefully observed, in addition to students being asked direct questions during interviews related to their peer relationships and influences.

As every student has experienced, teacher-student relationships have the potential to foster brilliant learning or intense conflict, which can have a significant impact not only on individuals within the class, but for the classroom culture as a whole. Tobin (2007) notes “that since the social and cultural backgrounds of the majority of the teachers [are] so different from those of their students, they might not know how to connect their teaching to the cultural capital of the students” (p. 27). Many teachers tend to conceptualize the ideal learning environment based on their own cultural backgrounds and educational experiences, which may be divergent from their students and thus deleterious to students’ learning. These teachers often use instruction and discipline styles that are at odds with the culture of the students, thereby promoting unfavorable interactions (LaVan, 2004). The relationships between students and teacher in this study are investigated to establish in what ways they are encouraging or hindering learning in this classroom setting.

Another important factor to be aware of in the science classroom is identity formation, which is especially critical during adolescent development (Santrock, 2001). For adolescents, identity formation is an ongoing process, affected by all areas of their social life. Due to this connection with social influences, identity in this study is viewed as being influenced by sociocultural factors. Studies in urban science classrooms have reported the importance of the role of identity in the learning process. For example, Cristobal Carambo, an urban high school science teacher researcher in Philadelphia, has
found that social identities are critical to the culture of the classroom and meeting classroom/community goals (Carambo, 2008). Additionally, it has been claimed that “Levels of altruism and interest in philosophical perspectives are heightened at this stage of development” (Walsh-Daneshmandi & MacLachlan, 2006), perhaps ideally situating adolescents at an optimal place for considering environmental issues. Identity issues and their relation to agency are further discussed regarding Gee’s discourse analysis in Chapter 2: The Methodology, in addition to implications related to environmental identity, one of the major focuses of this study, which are discussed in the section on environmental identity in this chapter.

It is also hypothesized that structures in fields outside the classroom, such as cultural and family background, have an impact on students’ learning. Students bring to the classroom a worldview that has been influenced by their ethnic culture, family values, and society (the media, etc). It has been stated by Cobern (1996) that “worldview provides a nonrational foundation for thought, emotion, and behavior. Worldview provides a person with presuppositions about what the world is really like and what constitutes valid and important knowledge about the world” (p. 584). From this definition, worldview can be seen as different from identity, which is focused on the self, whereas worldview involves how one perceives the world around them. These two constructs are of course connected as both are formed within the sociocultural context of one’s interactions with the world. The value that student’s may or may not place on science learning, in general, or a scientific “way of knowing,” makes it extremely important for teachers to make the subject material relevant to students’ lives and to help them reflect upon differences with their own “way of knowing” about the world (W. W.
Therefore, the course content and students’ responses to this content are closely observed in this study. In addition, interview questions and cogenerative dialogue topics are often focused on discovering how influences in students’ background and cultural experiences contribute to these reactions.

Overall, a sociocultural framework utilizing Sewell’s view of culture allows for exploration of structures operating both for individuals within the field of the classroom, and structures operating in broader fields, such as the greater school and home environments. By investigating how these structures interact with the agency of students and the teacher, this research begins to reveal the sociocultural factors that are enhancing learning in the classroom, and those that are preventing learning from occurring. It is the hope that in paying attention to these factors, barriers to student learning about the environment can be overcome as a result of this research.

The Research on Environmental Identity

In utilizing a sociocultural framework for this study, learning is viewed as a social process, just as environmental problems are viewed as existing within a social and cultural context. As noted by Clayton (2003):

An understanding of oneself in a natural environment cannot be fully separated from the social meanings given to nature and environmental issues, which will vary according to culture, world view, and religion” (p. 53).

This statement by Susan Clayton demonstrates the connection that has been shown to exist between our social interactions, our relationship with nature, and our identity. Clayton (2003) goes on to define environmental identity as

a sense of connection to some part of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the ways in which we perceive and act towards the world; a belief that the environment is important to us and an important part of who we are” (p. 46).
Thomashow (1995) states that “ecological identity refers to all the different ways people construe themselves in relationship to the earth as manifested in personality, values, actions, and sense of self” (p. 3). The term ecological identity here is used by some researchers in the field to connote a connection with the ecosystems that sustain us. Others prefer the term environmental identity because of its relation to “environmental issues” which is seen to be a more accessible term for the average individual (Clayton & Opotow, 2003). Although little consensus exists in the field as to which term is more appropriate, this research uses the term environmental identity to indicate that there are elements that go beyond an ecosystem focus incorporated into this aspect of identity.

As noted in the quotation above, Clayton (2003) views environmental identity as being inseparable from the social and cultural aspects of our lives. She further comments, “Identities originate within a social context that gives meaning to our encounters with nature. Identities also have social significance, promoting certain group affiliations and activities and discouraging others” (p. 59). In viewing environmental identity as a social phenomenon, Cronon (1996) adds that in the digital age, we must consider what young people are viewing on the television, internet, and the media regarding environmental destruction if we want to fully understand the genesis of an environmental consciousness.

There are others, however, that turn to more individual experience, thought, and struggle as the means of establishing an environmental identity. For example, Holmes (2003) describes how it is the “actions, concepts, meanings, and feelings” experienced in a specific place that allow “it to serve as a basis for or reflection of individual identity” and then adds that “perhaps place and self-hood are mutually codefining” (p. 30). Harold Searles (1960) claims that especially during adolescence, the individual is dealing with a
sense of inner conflict concerning his awareness that he is part of Nature and yet apart from all the rest of nonhuman Nature; and the two great ingredients of this inner conflict – man's yearning to become wholly at one with his non-human environment, and his contrasting anxiety lest he become so and thus lose his own unique humanness. (p. 114, emphasis in original)

Here Searles is essentially stating that we can only truly come to know ourselves through struggling with our relation to Nature and non-human others. Others have found that environmental identities can emerge from an intersection of moral and social responsibility (Kals & Ittner, 2003; Marcia, 1980; Zavestoski, 2003). In this study, environmental identity is viewed as being influenced by both internal characteristics and personal experiences, as well as social interactions with others.

One of the most thoroughly explicated theories of the development of environmental identity comes from Kempton and Holland (2003). According to Kempton and Holland (2003), there are three interrelated aspects of environmental identity formation. One aspect of development is a new awareness of environmental issues, whereby an understanding of environmental threats becomes more salient. In their study of environmental activists, interviewees often describe this stage of increased salience by using the word “aware” or “waking up.” This could be the result of direct experience with local environmental destruction or a connection with a larger environmental issue. As individuals move through different aspects of development of their environmental identity, Kempton and Holland refer to these identity processes as “reformulations.” The second type of reformulation occurs when an individual gains a sense of empowerment, during which she acquires a sense of agency, or a belief that one can act effectively either alone or as a member of a group. Kempton and Holland (2003) found that those that identify themselves as environmentalists have acquired this sense of empowerment by
taking on a role where action was a necessary part of one’s environmental involvement. In some cases, taking part in an environmental event or activity brought about an increase in salience or awareness of environmental issues and therefore, an adjustment in one’s environmental beliefs and values, rather than the other way around. A third type of reformulation occurs as one becomes more active in the environmental movement by carrying out actions and engaging in environmental practices. At this stage, an individual often becomes more knowledgeable about how to be an effective activist through the mentorship of more experienced others with common values.

Within this theoretical framework for the development of an environmental identity, it is important to note that Kempton and Holland (2003) include environmental action as a fundamental part of one’s environmental identity. Others see environmental identity as a motivating force that will guide personal, social, and political behavior (Clayton, 2003). Interestingly, Burke (1980) argues from a symbolic interactionist perspective that an individual’s identity is linked with their behavior, to the extent that one can better predict how others will behave through an understanding of their identity. Turner and Stets (2005) explain this piece of Burke’s theory as follows, “The meaning of an identity implies certain behaviors, and the behaviors confirm the identities that people claim” (p. 124). Similarly, for Kempton and Holland, action is not only seen as an outcome of increased salience and empowerment, but often as the experience leading to this increase, interlinking the relationship between action and identity development. Within this study, environmental action is incorporated into the concept of environmental identity as these are seen as being inseparable as one’s environmental identity is strengthened.
Another important distinction made by Kempton and Holland (2003) is the differentiation between two categories of environmental action, which they call “civic action” and “cultural reform.” The first of these includes actions aimed at reforming corporate behavior or actions of the government, including membership in environmental groups, petitioning local government, or grassroots organizing. In contrast, cultural reform often occurs at the individual level as a response to consumer culture. Environmentalists in this category attempt to be role models of environment-friendly practices in their own lives, and may also include efforts to influence others to reform their own practices as well. In the current study, this distinction is useful in determining which types of behaviors are encouraged by the teacher and also being considered by the students during the Environmental Science course.

Interestingly, while Kempton and Holland do mention that experience with nature or a specific local issue may increase the salience of one’s environmental identity, their explanation of environmental identity development lacks an explicit discussion of an emotional connection with nature. Similarly, several other studies have found that environmental identities often emerge as a result of direct experience in nature causing individuals to reframe their view of themselves and their connection with the environment (Clayton, 2003; Horwitz, 1996; Kals, Schumacher, & Montada, 1999; Kaplan & Kaplan, 1989). However, only two of these studies, those of Horwitz (1996) and Kals et al. (1999), emphasize the role of emotion in defining one’s relationship with nature. Horwitz (1996) conducted a qualitative study of 29 environmental activists, during which the participants were asked to write about life experiences that gave rise to their environmental beliefs. This study is quite unique in its approach to investigating the
developmental process of establishing an environmental consciousness. Findings from the study state,

For some in this investigation, pivotal experiences had a strong emotional or spiritual dimension (e.g. solitary experiences in nature; observations of environmental destruction); others, described influential experiences more dispassionately and as being more purely didactic or intellectual (e.g. books, philosophical and cultural explorations). In his study of animal rights activists, Herzog (1993) also found that some activists were originally motivated by emotional arousal directly regarding animals, whereas others had deliberately examined philosophical arguments and described development towards joining the movement as a progression of logical reasoning. Both patterns are also found in this investigation, particularly in terms of a role of formal philosophy and in a growing sense of emotional love for nature and outrage at its destruction...The emotional response seems to work synergistically with an intellectual foundation, particularly with one derived from informal reading, formal education, and teaching. (p. 50-51)

Notable in these findings is the emphasis on the role of the emotional in addition to logical reasoning in this process. An example from Horwitz (1996)'s study, where a participant expresses an emotional bonding with nature, is as follows: “As long as I can remember, I have enjoyed watching animals and being with nature....My love for the natural world and my concern for the environment definitely started when I was much younger. That concern and love still guide me” (p. 35). Or an expression of anger, such as, “I grew up in Southern California and saw natural places destroyed, paved, bulldozed. Even in the local state parks, the natural world was buried in regulations. It made me sad, and later, angry” (p. 38). Participants also express how family members have influenced their environmental ethic, as follows: “My grandmother was a horticulturist and professional florist, however nature (wildness) was her passion. It was reflected by my mother and...is the source of my motivation” (p. 36). Since Horwitz’s participants were environmental activists, many of these quotations are expressions of attachment to the environment. Although the students in the current study may or may not have such a
strong attachment, this study by Horwitz (1996) suggests the importance of considering emotion in the process of individuals developing or strengthening their environmental identity.

Using a quantitative methodology, Kals et al. (1999) deliberately explored the role of emotion in influencing nature-protective behavior with a questionnaire study of 200 participants from the general population (of Germany) and 81 environmental activists. Kals et al. (1999) investigated the relationship between a new construct “emotional affinity towards nature” and nature-protective behavior. Results showed that emotional affinity towards nature is as powerful a predictor of nature-protective behavior as indignation of nature destruction and interest in nature. Taken together, these three predictors explained up to 47% of variance of the outcome variable. Additionally, the study found that 39% of emotional affinity toward nature traces back to present and past experiences in natural environments. The authors conclude that their results confirm prior findings that “the provision of concrete experiences with nature is an effective strategy to promote ecologically conscious attitudes and decisions,” and suggest that environmental education programs should promote time spent in nature as a means of encouraging an emotional connection with the natural environment (Kals et al., 1999).

Mick Smith also writes insightfully on the role of emotion in the development of his own environmental identity in the recent book Emotional Geographies (2005). He states:

How can springs enter my soul, affect my emotions, and imbue me with deep-seated feelings of joy or mystery, desire and wonder? How can these natural events and places become part of the ethical topography of my life, sources and objects of moral sentiment?” (p. 221-2).
Smith speaks of emotion as being a key feature in “those intimate participatory practices that draw us closer to others, affecting our modes of being-in-the-world, giving us a feeling for and an understanding of our relational emplacement within that world (p. 219).” This chapter by Smith articulates what many express as being “moved-by” nature or feeling a “connection” with nature. In addition to the findings from Horwitz (1996) and Kals et al. (1999), these comments by Smith suggest that a thorough understanding of the development of environmental identity will not be complete without insight into the role of emotion in this process.

In the current study, environmental identity is viewed as a dynamic aspect of one’s identity that can gain or lose salience, in addition to being strengthened as one moves through the stages of environmental identity development, as suggested by Kempton and Holland. As the studies described above have shown a connection between experiences in nature, emotional affinity towards nature, and pro-environmental behavior, this dissertation research considers students’ environmental background and emotional experiences as important potential influences on students’ environmental identity and associated behaviors as they participate in the Environmental Science course.

**Symbolic Interactionist Theories of Emotion**

The findings of Horwitz (1996) and Kals et al. (1999) inform us that there is likely an emotional component to our interactions with the environment that has only begun to be explored in the field of environmental education research. Other fields, however, such as the field of sociology have been exploring the connection between emotion and attachment for decades. In the 1970s, the field of sociology turned to questions of the role of emotion in regulating self-processes, and how emotional
attachments shape interactions between people acting within social structures (Turner & Stets, 2005). Multiple theoretical approaches have emerged in this field with diverse emphases including ritual theories focused on synchronization of moment-to-moment interactions between group members, exchange theories in which emotions are seen as resources to be exchanged among individuals, structural theories focused on how power and prestige determine positive and negative emotions in individuals, and symbolic interactionist theories emphasizing identity as a prominent regulator of emotion and resulting behavior. Due to the connection between identity, emotion, and behavior that is the focus of symbolic interactionist theories of emotion, this group of theories is explicated below as a useful means of interpreting how students’ emotional responses may be related to issues of identity.

The symbolic interactionist theories have grown out of the conceptual synthesis of George Herbert Mead and Charles Horton Cooley in the first half of the 20th century, describing how social interactions allow each individual to predict and react to the behaviors of others as individuals attempt to maintain esteem in a social situation (Turner & Stets, 2005). According to these theories, emotional dynamics ultimately revolve around the processes of confirmation or disconfirmation of their situational identities in a social context. Due to the emphasis here on social influence, often guided by cultural norms, these sociological theories are in line with a sociocultural perspective of learning, which posits that learning occurs predominantly through social interaction and cultural influence. The symbolic interactionist theories extend the influence of social interaction to one’s identity, suggesting that it is difficult to separate one’s identity from the social and cultural context in which it is formed. These theories therefore become useful in
interpreting the emotions that individuals experience as their self-conception is affirmed or disconfirmed during the course of interaction (Turner & Stets, 2005).

If we conceptualize environmental problems as problems of social organization (Bell, 1998), and environmental identity as seen as existing within a social framework, then Zavestoski (2003) argues that symbolic interactionist theories of identity are central to understanding how identities result in specific roles and behaviors in society. Because this study examines the environmental identities of the participants within a social context, symbolic interactionist theories, specifically those of Stryker (2004) and McCall and Simmons (1978), are utilized in analyzing the emotional responses evident in the students’ reactions to events experienced during the course of the study.

Sheldon Stryker (1980, 2000, 2004) has built a theory of emotions centered around identity processes, placing the self within local social networks. In Stryker’s view, an individual may assume multiple roles within these networks resulting in diverse identities emerging in different settings (Turner & Stets, 2005). Accordingly, Stryker conceptualizes these multiple identities as organized into a “salience hierarchy” with those identities high in the hierarchy more likely to be enacted and situations where a more salient identity can be enacted, more likely to be sought out. For example, a nature enthusiast with this identity high in her salience hierarchy will likely seek out situations where this identity will be valued, thus reinforcing the prominence of this identity.

Stryker (2004) describes three ways to conceptualize the role of emotions in the identity process. The first of these considers an individual’s emotional response to others’ reactions to one’s “role performance” of a given identity. When others affirm one’s identity, positive emotions will be experienced, tending to raise the salience of that
particular identity. The higher the identity is ranked for an individual, the more acute will be their emotional response. In contrast, when one’s identity is disconfirmed, negative emotions will be experienced, forcing the individual to reevaluate commitments to an identity. Zavetoski (2003) relates the phenomena of the individual responding emotionally to others’ reactions to the enactment of one’s identity in the environmental realm. He conceptualizes “ecological identity as that part of the self that allows individuals to anticipate the reactions of the environment to their behavior” (p. 299). However, because there is no socially meaningful response of the environment to our actions, we must therefore depend on the responses of social “others” to affirm the actions corresponding with our “ecological” identities. This conceptualization by Stryker (2004) is particularly useful in interpreting students’ emotional responses to their experiences in the Environmental Science course that may be affirming or disconfirming aspects of the students’ identities.

The second conceptualization described by Stryker (2004) involves judging one’s identity as adequately meeting cultural expectations and frameworks of a specific social network. If a person feels that her “role performance” is meeting cultural standards, then that identity will be affirmed along with enhanced self-esteem. If a person does not believe they are meeting expectations, then they will experience negative emotions, particularly shame or guilt. Finally, the third way to conceptualize identity and emotion is that as a means of social control a person will tend to develop an identity that is affirmed, while lowering an identity in the salience hierarchy that is not meeting the normative expectations of a social network.
Further application of identity theory by Hitlin (2003) utilizes the concept of values as a connection between identity and emotion. Hitlin (2003) suggests a role for values in forming the core self, which are then applied through various situational identities. Similarly, Dittmar et al. (2007) states that each individual’s underlying value system acts as a guide for specific motives and behaviors. Hitlin refers to the conceptualization of values by Schwartz (1994) as "desirable transsituational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity" (cited in Hitlin, 2003, p. 119). Additionally, Schwartz (1992) and Schartz and Bilsky (1987) state that values meet five criteria: “(1) they are concepts or beliefs, (2) they pertain to desirable end states or behaviors, (3) they transcend specific situations, (4) they guide selection or evaluation of behavior and events, and (5) they are ordered by relative importance (cited in Hitlin, 2003, p. 119). According to Hitlin (2003), these values are enacted situationally through the development of various role or group identities. Notably, Hitlin (2003) also states that “the behaviors we enact as a result of our identities can cause us to reflect on our values and, over time, to find different values most compelling. When this happens, we experience shifts in our personal identity, our sense of ‘who we are’” (p. 122). In this statement Hitlin is connecting identity theory with values and behavior through the process of critical reflection.

In the current study, the participants’ values regarding the environment are explored as they are enacted through an individual’s situational identities. In addition to environmental identity, discussed above, central to current consumer culture is another aspect of identity referred to in this study as consumer-materialist identity. This aspect of identity, according to Richins (2004), involves a materialistic value endorsement which
can be described as the significance an individual assigns “to the ownership and acquisition of material goods in achieving major life goals” (p. 210). At the extreme, a person with highly materialistic values considers acquiring material goods as an important life goal and an indicator of success and self-definition (Richins, 2004). Several recent studies have found that current consumer culture is characterized by a growing materialistic value orientation characterized by the pursuit of wealth and material possessions in order to gain image, status, and happiness (Dittmar, 2004; Kasser & Kanner, 2004; Richins, 2004). As this study explores students’ identity, their environmental and materialistic values, perhaps often at odds with each other, are brought into focus as the activities in the class are aimed at helping students to reflect upon these values. As students’ environmental and materialistic values are affirmed or disconfirmed as a result of the activities in the Environmental Science course, this research seeks to discover in what way this may affect change in student’s environmental or consumer-materialist identity.

McCall and Simmons (1978) developed a similar identity theory to that of Stryker with the important addition of possible results when a person perceives a discrepancy between their own identity and situational or cultural expectations, resulting in negative emotions. As an individual attempts to placate these negative emotions, the possibilities include (1) “short-term credit” where a particular episode of nonsupport for an identity is essentially ignored as a one-time event; (2) “selective perception” so that elements of a situation are given selective attention thereby affirming one’s identity; (3) “selective interpretation” in which elements are accurately perceived, but interpreted allowing for identity affirmation; (4) withdraw from the interaction or situation that is disconfirming
the identity; (5) switch to a new identity that is more easily confirmed, and (6) “scapegoat the audience” faulting others for the disconfirmation process. These responses to identity disconfirmation are used within the study context to characterize students’ responses when fundamental aspects of their identity are challenged during the Environmental Science class.

This particular set of theories is utilized in this study because of the central role of identity for the adolescents in this study. Their environmental identity comes into question within the context of the Environmental Science classroom on a daily basis as they are being asked to question fundamental beliefs regarding how they view their own and society’s relationship with the environment. In addition to the environmental identity theories discussed in the last section, Stryker’s (2004) identity theory of emotion, as well as McCall and Simmons’s (1978), are critical elements used in the interpretation of the results examining changes in students’ environmental identity as they proceed through the Environmental Science course.

Heise’s Affect Control Theory

While Stryker’s (2004) and McCall and Simmon’s (1978) theories are useful in interpreting students’ emotional responses when aspects of their own identity are affirmed or disconfirmed, another social situation that may evoke an emotional response is when there is a lack of common understanding of the “performance role” of the social actors present. That is, if an individual has a different expectation than what is actually experienced, then this may lead to an emotional response. Another symbolic interactionist theory, Heise’s affect control theory, is a valuable framework for interpreting this type of situation. In Heise’s theory, emphasis is placed on how
individuals define the role of oneself and others within a situation. According to Turner and Stets (2005), this theory states that the level of emotional response to a situation is determined by the correspondence of what Heise calls *fundamental sentiments*, or culturally established expectations about identity roles and behavior, and *transient impressions*, or feelings about how individuals acting within a specific situation or event are meeting expectations. Within a situation, a classroom for example, students will have culturally established expectations of how the teacher should act or behave. If this expectation is in alignment with the individual student’s *transient impressions* of the teacher’s actual behavior, then this student will experience limited emotional arousal. However, if there is a discrepancy between the *fundamental sentiments* and the *transient impressions* regarding the teacher, then this will likely result in a stronger emotional response to the situation (Turner & Stets, 2005). Figure 1 in Chapter 5 shows a Venn diagram demonstrating in Case A: complete overlap of an individual’s *fundamental sentiments* and *transient impressions*; in Case B: a significant gap between an individual’s *fundamental sentiments* and *transient impressions*. Heise uses the term “deflection” to refer to this type of incongruity, and suggests that individuals will seek to limit the discordance between the *fundamental sentiments* and *transient impressions* often through reconceptualization of the situation.

From both the teacher’s and the students’ perspective in this study, both the establishment of goals for the classroom and the reaction of students to the enactment of these goals are impacted by expectations of the “teacher” role and “student” role at this particular high school. Therefore, this theory is utilized in analysis of the results, as the
teacher and students attempt to negotiate their roles within the Environmental Science classroom.

**The Role of Critical Reflection**

Smith (2005) suggests that “the process of ethical becoming requires an emotional openness to circumstance that enables the previously determined boundaries of our being to be re-constituted and re-interpreted” (p. 220-221). In this statement, Smith is suggesting a connection between our emotions and what could be called our ability to critically reflect upon our underlying values, beliefs, and understandings, and therefore our identity. In the context of the current study, this is significant because it suggests that both emotion and critical reflection may play an important role in identity development, in this case environmental identity. For example, emotional reactions to experiences in class may affect students’ willingness or ability to think critically about issues to which they are exposed in class, which may have consequences for their environmental identity.

Cobern (1996) has noted that all students come to the science classroom with an established worldview, which can be defined as “the set of fundamental, non-rational presuppositions on which [their] conceptions of reality are grounded” (p. 585). In order for students to undergo conceptual understanding during the learning of science, Cobern suggests that these underlying beliefs must be addressed. If they are not, then students may *comprehend* new science material, but will be unlikely to *apprehend*, or accept, what they are learning and successfully integrate it into their way of knowing about the world (Cobern, 1996). Students may then cling to alternative conceptions, in spite of being able to answer questions correctly on a formal assessment. *Alternative conceptions* are ideas that may be considered factually incorrect according to modern science, however,
"constructivist philosophy suggests that all of the learner's ideas—even the ones we think obviously wrong—have some value because they are part of a process that eventually can lead to a better understanding of the natural world" (Koch, 2005, p. 18). In an Environmental Science course, getting students to critically reflect upon their alternative conceptions may mean helping students consider some underlying aspects of their identity, which may go beyond the basic notion of teaching for "conceptual change" in students' understanding of a scientific concept. For example, a student may not be able to fully apprehend ideas regarding the source of their food without considering on a deeper level what this means for her environmental identity and associated behaviors. Here we see the connection between worldview (ex. what students view as an acceptable food source) and identity (ex. meat-eater vs. vegetarian), which may make it difficult for students to accept environmental information that they are learning in class.

Critical reflection is defined by Jack Mezirow, one of the founders of transformative learning theory (discussed further below), as "a process by which we attempt to justify our beliefs, either by rationally examining assumptions, often in response to intuitively becoming aware that something is wrong with the result of our thought, or challenging its validity through discourse with others of differing viewpoints and arriving at the best informed judgment" (cited in Taylor, 2001, p. 220). Although this process could be similar to that experienced by students in an Environmental Science course as they are guided in the process of examining their underlying assumptions about humanity’s relationship with the environment, it is unclear what the role of critical reflection is in bringing about change in students’ environmental identity and pro-environmental behaviors. Therefore, this research project investigates the extent to
which critical reflection is embedded in the curriculum, whether students are critically reflecting on their relationship with the environment and their behavior, and whether this reflection is leading to change.

Critical thinking is envisaged by Richard Paul as a set of characteristics, some of which may be observable in this study, such as “intellectual courage” or a willingness to consider the viewpoints of others, or “intellectual empathy” which is the ability to put oneself in the place of others to consider their viewpoint (Paul & Elder, 2001). While observing students to see if they are exhibiting these characteristics, this research also considers the extent to which activities are promoting critical thinking skills, as discussed by Raths, Wassermann, Jonas & Rothstein (1986) in *Teaching for Thinking: Theories, Strategies, and Activities for the Classroom*. These skills include interpreting (how one views an “experience” and investigating how one’s views compare with the facts/data of the situation), criticizing (making judgments, analyzing, and evaluating based on a set of standards; learning to use evidence to supports one’s criticism/opinion), looking for assumptions (What are we assuming to be true in order to make a certain claim?), imagining (thinking creatively, often not data or fact based), collecting and organizing data (inquiry based learning–based on students’ own interests and questions), hypothesizing (suggesting answers to a question based on prior knowledge), or decision-making (deciding “What should be done and why?” by considering one’s values along with facts and principles) (Raths, Wassermann, Jonas, & Rothstein, 1986, p. 17). This list of skills is not exhaustive, and there is a debate regarding whether critical thinking should be conceptualized as a set of characteristics, skills, or as part of the natural development of conceptual understanding; however, that discussion is beyond the scope of this paper.
The ideas listed above are meant to provide examples of the type of critical reflection that is practical to observe in the research setting.

In the context of the research question, this study pursues questions such as: Does critical reflection lead to an “aha!” moment for students? Is reflection a gradual process that occurs over a period of time? Does critical reflection seem to be necessary for change in students’ environmental identity and their pro-environmental behavior to occur? In order to investigate which activities are promoting this type of reflection in students, students are asked during interviews and cogenerative dialogues which activities/discussions, if any, are causing them to think critically about their own ideas, why they perceive that the activity had this impact, and how it has affected their views about the environment and their pro-environmental behavior. Additionally, the teacher is asked during her interviews what she views as the role of critical reflection in the course and specific activities, and how she sees this type of thinking as interacting with emotion.

**The Process of Change**

The research mentioned thus far is informative in establishing a framework with which to investigate the question: What does the process of change in students’ environmental identity and pro-environmental behavior look like in the Environmental Science classroom? This framework combines ideas from the fields of environmental education research, science education research, and sociology as a means of considering the relationships that may exist among identity, emotion, critical reflection, and behavior. In this final section of the conceptual framework, I discuss several ways that students could experience change while participating in the Environmental Science course, including a discussion of what can be learned from transformative learning theory.
In assessing the type of change that is occurring in students through the lens of Stryker’s (2004) identity theory of emotion, there are several possible paths through which this change could occur. For example, a student may already have deep environmental values, but is learning practical ways to change their behavior as a result of this class, thereby affirming or strengthening her environmental identity. Students may begin by experimenting with piecemeal changes in behavior, as they struggle to find practices that are feasible for them. Or a student may amend, but not drastically change, her beliefs in response to topics learned in class that disconfirm her consumer-materialistic values. In contrast, a student may go through a drastic transformation in beliefs and behavior as she participates in an Environmental Science course – this possibility is considered further below in the section on transformative learning theory. Finally, it is also quite possible that students will practice some of the defense mechanisms suggested by McCall and Simmons (1978) when their identity is disconfirmed, and not change their environmental identity or their pro-environmental behavior as a result of this class. Part of this investigation is therefore aimed at determining the sociocultural structures that are limiting these students from adopting pro-environmental beliefs and corresponding behaviors. At the same time, the study aims to determine those affordances that are allowing other students to become more environmentally conscious in their thoughts and actions.

For the purposes of this study, it is important to define a measure of “substantial” change in a students’ environmental identity. Kempton and Holland’s stages of environmental identity development are utilized for this purpose in the analysis of the study results. For example, significant movement of a student from the salience stage
into the *empowerment* stage of environmental identity development (or from the *empowerment* stage into the *activist* stage) signifies a “substantial” change for that student. Another example of a “substantial” change would be if a student moves more firmly into the *empowerment* stage as a result of increased feelings of self-efficacy. This would be likely to occur if a student enters the class already participating in some pro-environmental behaviors, but strengthens her environmental identity during the course and takes on new environmentally friendly behaviors. If a student only increases the salience of her environmental identity by learning about new environmental issues without it affecting her behavior, this is not considered “substantial” change in the current study.

Kempton and Holland’s stages of environmental identity development were chosen to define “substantial” change for this study for three main reasons. The first reason is that in the recently expanded literature on environmental identity, this is the most clearly defined framework for analyzing the process of environmental identity development. Other studies in the field consider the present level of participants’ environmental identity by attempting to measure it quantitatively (Clayton, 2003; Kals & Ittner, 2003), focus on specific obstacles to maintaining one’s environmental identity over time (Zavestoski, 2003), or consider the influence of specific experiences in nature on environmental identity (Horwitz, 1996), but none of these studies clearly delineates stages of environmental identity development.

The second reason for utilizing Kempton and Holland’s stages of environmental identity development is that the stages provide a useful description that is easily observable in the field of the classroom and from student interviews. For example, as
students learn new information in the Environmental Science course (evidenced from class work and discussions) they move further into the salience stage of environmental identity development, while students that increase their self-efficacy through participation in new environmental behaviors are moving into the empowerment stage of environmental identity development. If a student begins to participate in activities at the community level outside the classroom, then this would be evidence that a student has entered into the activist stage. Therefore, these stages are useful in describing the changes students are experiencing during the Environmental Science course.

A final reason for utilizing Kempton and Holland’s stages of environmental identity development is that it allows for a description of change at multiple levels that can account for more subtle changes over time rather than an “all-at-once” change between more extreme levels of development. In the discussion of transformative learning theory below, the reasons for not expecting a sudden change in such a complex process as environmental identity are more thoroughly explicated.

**Transformative Learning Theory.** For some students, it is possible that taking an Environmental Science course may deeply impact their environmental views. The field of transformative learning theory has been developed to explore change that is “transformative” for individuals, and several hypotheses have arisen to explain the process that individuals go through as they change deeply held beliefs. In this section, I describe recent findings regarding transformative learning theory, in addition to sharing current criticism. Finally, I discuss some of the questions raised by transformative learning theory that are explored in this dissertation research, specifically the interplay of
emotion and critical reflection during the process of change in students’ environmental identity and behavior.

According to Jack Mezirow, one of the founder’s of transformative learning theory, the process of transformative learning “involves transforming frames of reference through critical reflection of assumptions, validating contested beliefs through discourse, taking action on one’s reflective insight, and critically assessing it” (Mezirow, 1997, p. 11). One of the key features of transformative learning is critical reflection, which was defined above. The first major criticism of Mezirow’s ideas is that he pays too much attention to cognitive factors and rationality, and needs to focus more on emotional and affective components of transformative learning. A thorough critique was offered by Edward Taylor (2001) by looking at transformative learning through the lens of neuroscience. In his article entitled “Transformative learning theory: a neurobiological perspective of the role of emotions and unconscious ways of knowing” Taylor explains how “contemporary research is revealing a more integrated relationship between the physiological process of cognition and emotion” (p. 222). Historically, these were seen to be separate functions of different areas of the brain. However, it is now evident that decision-making is often directly guided by emotions, often on a non-conscious level. According to Taylor, emotions establish the agenda for desires and beliefs, and they help us decide what to consider cognitively and how to respond. Therefore, he suggests that transformational learning is often guided by or interconnected with emotions and feelings, and that critical reflection and emotions are interdependent processes (Taylor, 2001).
Within the field of research on environmental activism, Kovan and Dirkx (2003) offer a similar criticism from a psychosocial perspective. They suggest that Mezirow's approach understates the importance of sociocultural context, and the role of emotions and spirituality in transformative learning. Their findings show that commitment to environmentalism is largely spiritual, involving elements in the non-rational realm, with activists working through stages of hope and despair, while maintaining their passion for the cause. They conclude that the inner self is very involved in working through these stages (utilizing both rational and non-rational elements), and suggest that transformative learning is a long, sustained process occurring over a considerable period of time (Kovan & Dirkx, 2003). This last finding is important to consider in the current study because this may indicate that it would be difficult to “see” transformative learning occurring in a student during a semester-long course, if this type of change tends to take place over a longer time period.

Acknowledging that transformative learning is quite complex, and actually may involve both rational and emotional components, Valerie Grabove summarizes this critique of Mezirow in her essay “The Many Facets of Transformative Learning and Practice,” beginning with the following quote: “The transformative learner moves in and out of the cognitive and the intuitive, of the rational and the imaginative, of the subjective and the objective, of the personal and the social.” There is a possibility, then, of interconnecting what she calls “two layers that work in tension” (Grabove, 1997, p. 89). This seems to be an accurate description that accounts for both the rational decision-making and emotional components of transformative learning. This research suggests that if we want to affect change in students’ relationship with the environment, we need to
focus on creating cognitive and also affective ties with the environment, and help students work through some of the emotional struggles involved in the process of critical reflection of one’s values.

A final critique also offered by Edward Taylor (2001), suggests that the process of transformative learning involves elements operating on a non-conscious level. He discusses the importance of implicit memory in the learning process, which he defines as the unconscious work of the brain in processing past experiences. An important implication of his research is that implicit memory has a large role in developing skills (riding a bicycle) and habits. Taylor emphasizes that we carry out many skills and habits without explicit (declarative) memory. This raises important questions about the importance of helping students to gain an awareness of their own actions and habits (bringing the unconscious to a conscious level) before they can successfully change their environmental behavior.

In this research, I investigate the role of critical reflection and emotion in the process of students changing their environmental identity and pro-environmental behaviors. As noted above, the extent to which this change is transformational may be very difficult to assess in the time span of a semester-long course, and is therefore not a goal of this research; rather, the measure utilized for “substantial” change in this study is Kempton and Holland’s stages of environmental identity development. However, the initial work that has been done in the field of transformative learning theory is informative in posing some of the questions that need to be further explored in documenting how individuals’ sociocultural experiences affect change in aspects of their identity and behaviors.
The intention of this research is to find out from students how they are experiencing change in their environmental identity and associated behaviors, and how experiences in the classroom are contributing to or impeding this process. The teacher’s voice is also viewed as important by providing perspective on the teacher’s decision-making processes in creating the curriculum for the course because these decisions impact the types of activities that become the students’ experiences in the class. By asking students directly how these activities are affecting them, in addition to directly observing interactions in the classroom, this research furthers our understanding of how an Environmental Science course can influence development of students’ environmental identity and related pro-environmental behaviors.

**Summary of Conceptual Framework**

This study moves the field of environmental education research beyond the established environmental literacy approach of “knowledge, skills, attitudes, behavior” towards a new sociocultural approach that explores the process of change in students’ environmental identity and their pro-environmental behavior during a semester Environmental Science course. Many studies in environmental education have been conducted to investigate if change is occurring in students as a result of varying types of programs in the formal and non-formal education sectors; however, a shift in focus is required to begin exploring the specific changes in further depth and discovering why and how change is occurring (or not occurring) in students in the classroom context. A sociocultural approach based in the view of *culture* in the field of cultural sociology allows for exploration of structures such as peer-peer relationships, student-teacher relationships, teacher and student environmental background, cultural influences, external
influences such as the media, and teaching and curriculum strategies. From the existing research, the factors that are focused upon in this study include identity, emotion, critical reflection, self-efficacy, and pro-environmental behavior. The next chapter describes the methodology - qualitative ethnography utilizing participant observation, videotaping, formal interviews, and cogenerative dialogue - that is utilized to best answer the research question:

- *How do we characterize the process of change in students’ environmental identity and pro-environmental behavior during an Environmental Science class?*
CHAPTER 2

METHODOLOGY

Rationale for Research Methodology

The conceptual and practical challenges inherent in my attempt to examine the process of change in students’ environmental identity and pro-environmental behavior in the Environmental Science classroom demand a methodology that is both specific and circumstantial. On the one hand, the research requires a clear picture of the interaction of the individual and community at the level of classroom teaching and learning. On the other hand, it demands an understanding of the multi-layer situation involving the sociocultural elements that are affecting both the students and the teacher during their life experiences both within and outside of the classroom. Within the landscape of qualitative research, ethnographic fieldwork provides the best approach to address both specific (particularistic, context-specific, local, in depth) and circumstantial (relevant in a broader context) dimensions of learning in the Environmental Science classroom. The nature of ethnography foregrounds problems in meaning and context (Agar, 2006b), which allows for the exploration of how students are making meaning of their experiences in the context of the Environmental Science classroom. Specifically, this work explores the following questions:

1. How do students define their relationship with the environment and what behavior do students exhibit regarding the environment? What characteristics of their background have influenced these beliefs and actions?
(2) What is the teacher’s perceived and actual role in influencing her students’ understanding of their relationship with the environment and pro-environmental behavior?

(3) How are students’ environmental identity and pro-environmental behavior changed as a result of taking an Environmental Science class? What are the leverage points (activities, experiences, etc) for change? How do emotion, critical reflection, and other factors, such as self-efficacy, impact students during influential activities?

(4) How do the interactions of students with the sociocultural structures of the classroom affect the (potential for) change in students’ environmental identity and associated behavior?

Sources of Data

Each of these research questions is explored through a subset of the following qualitative research strategies including: participant observation, videotaping, formal interviews, and cogenerative dialogue. The first layer of data collection, which can be characterized as ethnographic description, is primarily addressed through participant observation and videotaping. A second layer of data is collected through formal interviews and cogenerative dialogues.

Participant Observation

During participant observation, which has been characterized as the defining strategy of ethnography, the researcher encounters events as they unfold in naturally occurring situations, and attempts to “experience events and meanings in ways that approximate members’ experiences” (Emerson, Fretz, & Shaw, 1995, p. 2). In the context of this study, this translated into attending class sessions (one section of Environmental Science) throughout the semester on a daily basis, and fully participating in classroom activities, either with students during group work, or as a facilitator, as was requested by the classroom teacher. Field notes were kept daily in a field journal, including both
reflexive and reflective sections. Using the framework provided by Gee’s discourse analysis (discussed below in this chapter) and the unit of analysis of activity (as discussed in Chapter 1), observations focused on relationships and interactions among participants as they participated in classroom activities. Throughout the research period, it was critical to observe and record data regarding peer-peer interactions, as well as interactions between the students and the teacher. Additionally, monitoring students’ reactions to teaching strategies and activities provided insights that were explored at a deeper level through the other research methods. Participant observation also allowed the researcher to observe the enacted curriculum by being present during classroom activities, allowing a record of daily activities to be kept as well. The researcher focused on how explicitly the teacher encouraged reflection of students’ understanding of their relationship with the environment, in addition to how openly the teacher shared her own environmental views with students. Especially of interest given the emphasis on the factors influencing students’ environmental identity and behavior was noticeable expressions of emotion, moments of self-reflection and questioning by students, as well as patterns indicating more passive or active roles in the classroom providing information about the role of social norms. Field notes recorded during participant observation were helpful in identifying contradictions within the classroom structure that emerged during the semester, in addition to acting as a formal check to ensure accuracy of the other forms of data. Finally, participant observation allowed for monitoring of changes both in students and in classroom structures as a result of cogenerative dialogue.
Videotaping

Videotaping the class several days during the semester provided a record of classroom activities that augmented field notes, in addition to being used to prompt discussion during interviews and cogenerative dialogues. Classes were videotaped one to two days per week, specifically during interactive activities when the researcher anticipated discussion between teacher and students or group work, as was indicated ahead of time by the teacher. The video camera was placed in a stationary position during these activities, so as to not be distracting, although it was moved occasionally to focus on a specific group or on the teacher. Video was not taken when students were reading or writing individually, or completing worksheets or tests. Video vignettes of 30 seconds to 3 minutes of class time were selected providing “a focal point for discussions about what is happening, and why it is happening. In so doing participants can identify the patterns associated with what customarily happens and the associated contradictions” (Tobin, p. 3). Vignettes were selected if they were seen as providing potentially useful information regarding the topical questions listed above, often demonstrating either a common or unusual occurrence in the classroom. The videotapes provide several levels of analysis at the micro-, meso-, and macro-levels. Video clips provide a meso-level perspective of classroom interactions when viewed at normal speed, where meso refers to the unfolding of events in real time. All tapes were reviewed at normal speed within a few days of the recording, and notes taken on significant events and interactions using the same criteria as that described above for field notes. Micro-level analysis occurs by slowing the videotape to play at intervals as slow as hundredths of a second to uncover cues regarding nonverbal interactions (Martin et al., 2006). Approximately ten segments
of the videotapes that were related to emerging themes were chosen to be analyzed at the micro-level, and were then transcribed verbatim, and used as a written data source. By serving as prompts for discussion about a specific event, videotapes can also function at the macro level (Bayne, 2008) adding another layer of complexity to the reflective process (Martin et al., 2006). One of the main benefits of videotape is that it allows for analyses of actual data sources, rather than relying on participants’ memories of past events as focal points for interviews, cogenerative dialogues, and informal discussions. For example, a segment of classroom video where the teacher was speaking to students about a particular environmental issue was clipped, and shown to students during cogenerative dialogues in order to prompt discussion regarding the students’ response to the teacher’s argument and whether they thought it was convincing or not. It should be noted that while fifteen classes were videotaped (~90 minutes each), and all were reviewed at the meso-level, only a very small portion of the tapes (10 thirty-second to three minute segments) were analyzed at the micro-level. Future analysis will be conducted with these videos in order to gain even further understanding of the interactions that occurred in the classroom during the Environmental Science course.

Formal Interviews

A second layer of data was collected through formal interviews and cogenerative dialogue. Silverman (2007) cautions us that the use of interviews moves us out of the realm of “naturally occurring” data and into a realm of co-constructed meaning (p. 51); however, interviews provide direct insight regarding how participants are making meaning of their experiences at a level that cannot always be observed in a natural setting. In this study, interviews were used specifically to learn about student and
teacher's background with environmental topics, what participants' felt were the strongest influences upon them (both inside and outside the classroom) regarding their environmental identity and pro-environmental behaviors, and what teaching/curriculum strategies were working/not working for them within the classroom. The teacher and seven students were interviewed three times during the semester (beginning, middle, and end), while three students were interviewed twice, and one student only once. Of the three students interviewed twice, one was absent due to illness during the middle of the semester; another student expressed interest in being interviewed halfway into the semester, and therefore was interviewed at the middle and end of the semester; and the third student was failing the class and did not come to class during the last week, and therefore did not complete the final interview. The student that was only interviewed once dropped the class before the middle of the semester, and therefore was only interviewed at the beginning.

It was important to interview a diverse selection of students within the class, including those who were directly involved with cogenerative dialogue and those who were not, in order to differentiate between these varied experiences. All students' that volunteered to be interviewed (N=10) at the beginning of the semester were interviewed in the first three weeks of school. These students represented a diverse sampling of students based on gender, achievement level, classroom involvement, social group, and answers on the surveys (see below). Each interview ranged from 30 minutes to an hour in length, and all interviews were audio-taped for later transcription and analysis. The first interview with the students focused on participants' environmental background, initial impressions of the course, and students' environmental beliefs and behaviors when they
entered the class. The second interview probed more deeply into students’ environmental background and beliefs, in addition to focusing on students’ reactions to activities in class and peer-peer and teacher-student relationships. The questions during the third interview explored how students’ environmental beliefs and behaviors changed (or did not change) during the semester, which activities students’ found to be most influential, and what the affordances and obstacles were to change occurring. The questions asked during the first interview with the students include:

Questions for Student Interview 1

(1) What do you like to do in your free time?

(2) Do you like school? Any particular subjects?

(3) What do you hope to do when you graduate?

(4) Have you taken any other Environmental Science course before? Did you study Ecology in a Biology class? If so, what do you remember most from that course or unit? Did that course or unit have any influence on you?

(5) Have you ever worked on an environmental action project? How did that experience influence you?

(6) Do you spend a lot of time outdoors? Did you in the past? Doing what types of activities?

(7) Do you do any environmentally-related behaviors at home or outside of school? (refer to behavior survey) Why or why not? How do your parents feel about environmental issues? Do they encourage you to do any pro-environmental behaviors? Do you agree with your parents views? Why or why not?

(8) Why are you taking this Environmental Science class?

(9) Have you learned anything so far that has been surprising to you or that you didn’t already know? Can you give an example?

(10) hat would you say are your goals in the course?
(11) How do you think the class is going?

(12) What is working for you so far and what is not? What would you change about the class, if you had the power to do so?

(13) What do you see as your role in the class dynamics? Who are you friends with? Do you have any ideas about what Mrs. P thinks about you?

(14) Take out the student’s attitude survey, and ask student why he/she feels the way they do about certain statements (perhaps ones they feel strongly about or one’s they are unsure about).

(15) What is your opinion of Mrs. P so far? (remind students that she will not hear this) What do you think her goals are for the course? How do you feel about these goals?

(16) What do you think of when you think of an environmentalist? Do you consider yourself to be an environmentalist? Why or why not?

During the second interview with the students, the following questions were asked:

**Questions for Student Interview 2**

(1) What do you think are the major influences in determining how you view the environment? In what way have they influenced you? Students will be encouraged to tell a story here demonstrating this influence. Students will be given a card with the following options:

- parents
- other family members
- friends
- experiences in nature
- the media
- teacher
- information you’ve read
- a certain class
- a certain activity
- others?

(2) How is the class going at this point? What would you change about the class?
(3) Has this Environmental Science class so far made you reconsider any views towards the environment that you held when you entered the class? If so, in what way? If not, why not?

(4) Have there been any discussions/activities in this class that have really challenged you to think about something in a new way or been particularly influential?

(5) Have you changed your behavior in any way as a result of taking this class? Do you think Mrs. P is trying to influence your behavior? Is she convincing? Why or why not?

(6) Has anything you've done in class made you care more about the environment? Has anything made you angry or frustrated?

(7) What is your opinion of Mrs. P at this point? How would you describe your relationship with her?

(8) How do you feel about the environmental views being promoted by Mrs. P? Can you give an example of where you agree or disagree with her?

(9) (For students participating in the cogenerative dialogues) What do you think of the cogenerative dialogues so far?

(10) Explain to students about the Preservation/Utility graph. Where do you see yourself on the Preservation/Utility graph? Where do you see Mrs. P?

(11) “The so-called “ecological crisis” facing humankind has been greatly exaggerated.” Do you agree or disagree with this statement? Why? Add scale of 1-5 here.

(12) “I feel I can make a difference in helping the environment.” Do you agree or disagree with this statement? Why?

(13) “Trees have as much a right to exist as humans.” Do you agree or disagree with this statement? Why?

(14) What do you think is the most important environmental issue? Why?
The questions asked during the third student interviews include:

**Questions for Student Interview 3**

(1) What did you think of the debate? What did you learn from it?

(2) What did you think of this unit on climate change? Did you learn anything you didn’t know before? Such as…What did you think of the field trip? What did you learn from it?

(3) Did you notice any change in Mrs. P’s teaching style during the semester?

(4) Which activities/discussions were the most influential on you over the semester— in what way? Provide list of major activities.

- World population growth – ticker
- LDC’s and MDC’s notes
- Old Growth Forest Power Point
- Rainforest Power Points (Mrs. P and Ms. Blatt) – Costa Rica
- Making Rainforest Pamphlets
- Jay-ex Movie – Logging
- Inventory – Everything I Own
- Ecological Footprint
- Energy Pyramid and Carbon Cycle
- Primary and Secondary Succession Notes
- Town Meeting – Wetlands and Development
- Tree Coring/Types of Trees
- Waste Management Field Trip
- Princess Mananoke
- Recycling
- PETA movie
- Jay-ex Movie - Tiger
- Endangered Species project
- Global Warming Exxon Valdez movie/Homer, Alaska
- ANWAR movie

(5) What is your expected grade in the class? Are you satisfied with that grade? What would have helped you to do better?

(6) How would you describe your role in the class? Who did you become friendly with in the class? How did those students influence you during class?

(7) Do you have a new perspective on any of the outdoor hobbies that you have – hunting, ATVing, fishing, etc?
(8) Do you think this class has influenced your environmental beliefs and behaviors [probably answered above]? What other factors contribute to your willingness/ability to change your beliefs/behaviors?

(9) Would you want to change your environmentally-related behaviors if your circumstances were different? In what way?

(10) Do you think Mrs. P was trying to influence your environmental beliefs? How about your behaviors? Did she? If so, in what way? If not, why not?

(11) If so, did she try to influence you more by teaching you new knowledge about the environment or influence you emotionally? Can you give an example of either? Both?

(12) How did you feel about a teacher trying to influence your attitudes and behaviors? Do you think this is a proper role for school?

(13) Would you say you have accepted or rejected most of the ideas put forth by Mrs. P? Do you think that is because of something in your background or experiences? If so, what?

(14) Did you discuss anything you learned in this class with your family? What was their reaction? Did anything happen as a result of the conversation in your family’s behavior towards the environment?

(15) How would you describe an environmentalist? Do you think your ideas about environmentalism have changed during this course? Do you consider yourself an environmentalist?

(16) If interview is after the student has taken the attitude/behavior survey, ask them about items that have changed on either? Why? Also ask for an explanation of some of their answers on the attitude survey.

(17) How do you think having a researcher in the class influenced the class? Did it influence you personally?
(18) [For students who participated in the cogenerative dialogues] What did you think about cogenerative dialogues? Did they have any influence on your environmental attitudes or behaviors? Did they influence your comfort level with Mrs. P? How about with your classmates? Did you notice any changes in class that were a result of the dialogues?

(19) What do you think is the most important environmental issue in the world at this point?

The teacher interviews focused on the teacher’s environmental background and beliefs and goals for the course (Interview 1), the teacher’s assessment of how various activities were affecting students (Interview 2), whether the teacher’s goals for the course had been met, and the obstacles and affordances to accomplishing these goals (Interview 3). All interviews were audio-taped for later transcription and analysis. The first interview with the teacher lasted 70 minutes, and the questions asked are as follows:

**Questions for Teacher Interview 1**

1. Can you describe your educational and environmental background?
2. What are your main goals in teaching Environmental Science? What do you hope a student will get out of your class?
3. Can you give me an overview of your course, as much as you know, unit by unit?
4. What concepts do you hope your students learn this semester?
5. What skills do you hope your students learn this semester?
6. What do you think the role of an Environmental Science class should be in affecting the environmental attitudes and behaviors of students?
7. What do you see as the obstacles and supports for you achieving your goals in the classroom?
8. How would you characterize your own environmental attitude/ethic/worldview and environmental behaviors?
9. How do you decide how implicit or explicit to be in influencing students’ attitudes and behaviors?
(10) What teaching strategies have you found that really work in influencing/transforming students’ environmental attitudes and behaviors? What have you found really doesn’t work?

(11) How would you characterize your interactions with your students?

(12) How do you think your students view you?

(13) What pressures (parents, peers, media, teachers, etc) do you perceive to be acting on students regarding their environmental attitudes and behaviors?

(14) Do the students explore those pressures in your class?

(15) What do you see as the role of activities based on critical thinking versus those based on trying to create affective ties with the environment in affecting students’ attitudes and behaviors?

(16) What about beliefs, desires, wants and needs? Other rational and non-rational elements?

(17) How about the role of social action type activities?

(18) How important is time spent outdoors?

(19) What are some upcoming activities that you have planned?

The second interview with the teacher was conducted during two sessions, due to time constraints. Both sessions lasted approximately 45 minutes each. The questions asked during the second interview are as follows:

Questions for Teacher Interview 2

(1) Overall, how do you feel the class is going so far compared to your expectations? How is this class different from past classes? Is your teaching approach different at all?

(2) What teaching strategies would you say have been effective and ineffective so far this semester? What do you think is really working/not working in this class?

(3) Which activities/topics do you think have been most influential for students? Were these because they appealed to their emotions? If so, in what way? Or was it because it made them think critically? If so, in what way?
(4) Do you feel like you are influencing students in terms of their attitudes towards the environment? If so, which students? Do you have any examples of this?

(5) How explicit do you find yourself being in trying to influence students’ behavior in this class?

(6) Do you feel like you are influencing students in terms of their behavior towards the environment? If so, which students? Do you have any examples of this?

(7) What do you think determines which students are influenced by the class and which aren’t?

(8) What do you feel are the major obstacles to your teaching in this class?

(9) How do your relationships with various students influence your teaching?

(10) “I’ve noticed that before the town meeting, you didn’t seem very comfortable letting these students explore independently or work in groups. Why is that?” What did you think about the town meeting?

(11) What do you think of the cogenerative dialogues so far? Do you have ideas for future dialogues?

(12) How would you say students reacted to the agricultural practices movies (King Corn, PETA, etc)? As you expected or differently?

(13) Do you feel you present a balanced or a one-sided approach to Environmental Science? Which is your goal?

(14) Do you (1) have an ecocentric or anthropocentric environmental ethic and (2) which are you trying to promote amongst your students - ecocentric or anthropocentric ethic - and why?

(15) Explain to Mrs. P about the Preservation/Utility graph. Where do you see yourself on the Preservation/Utility graph? Where would you like your students to be?

(16) Would you say your goal with your students is to develop a sense of care for nature, awareness of environmental issues, or to influence their behavior?

(17) What are your goals for the rest of the semester?

(18) What do you have planned for the rest of the semester?
(19) How has having a researcher in the class influenced the class?

The third interview with the teacher was also conducted during two sessions again due to time constraints. The first session was 50 minutes, while the second session was 42 minutes. The questions asked during the third interview are as follows:

**Questions for Teacher Interview 3**

(1) How did you think the second half of the semester went?

(2) How did you think the debate went?

(3) Over the semester, what do you think went really well?

(4) What were the biggest obstacles?

(5) Do you think you influenced students’ attitudes and/or behaviors? Do you have any evidence of this? Which students do you think changed? Which activities do you think were the most influential? Why?

(6) What do you think determines which students are influenced by the class and which aren’t?

(7) You stated in the first interview that your goals for the class were planting seeds for students’ future behavior? What do you see as the obstacles and supports for you achieving your goals in the classroom? Were the obstacles and supports different from other years?

(8) How do your relationships with various students influence your teaching (this may have been answered in previous questions)?

(9) What is your notion of an environmentally responsible person?

(10) How would you describe the path a person goes down in becoming an environmentally responsible person? How did you support students to go down that path in this class?

(11) Are you familiar with the idea of sense of place? Do you think that these students come into this class with a sense of place? Do you think that developing sense of place ought to be part of an environmental science class? Did we do any activities where you had this goal in mind?
(12) Earlier in the semester, you mentioned that you like to take the students outside, but the class only went outside on two days, why so little? Would have liked to have taken students outside more? What were the obstacles to doing so?

(13) A lot of these students seem to have self-esteem issues; do you think that affects their ability to become active environmentalists?

(14) In terms of my research, what was your overall impression of the cogenerative dialogues? Did they influence your relationship with the students at all? Did they influence your teaching?

(15) How did I influence your teaching, if at all?

Cogenerative Dialogues

Cogenerative dialogues, which are group discussions amongst stakeholders (e.g., teachers, several students, and administrators), “afford the examination of shared experiences within a field—a physical and temporal place where individuals interact with each other—in order to co-create new culture and/or amend that culture which already exists, as a means to improve the quality and efficacy of teaching and learning” (Bayne, 2008, p. 3)—the concept of “culture” was explored in Chapter 1. The process of cogenerative dialogue was developed by the Discovering Urban Science (DUS) Research group as a way to provide teachers and students with a social space to discuss their perspective on what it is like to “be in this classroom” in order to identify issues and co-generate possible solutions for resolving these issues. In the words of Roth, Tobin, and Zimmerman (2002), cogenerative dialogue offers an opportunity for classroom participants to share “current understandings to describe what has happened, identify problems, articulate problems in terms of contradictions, and frame options that provide new and increased choices for enacting teaching and learning” (p. 6). Cogenerative
dialogues can include many different participants, including teachers, any number of students, classroom researchers, parents, and administrators, but commonly take the form of a small group meeting weekly to discuss their experiences in the classroom and how to improve the learning culture for both the teacher and students (Martin et al., 2006).

Cogenerative dialogues are guided by three rules, which have come to be called Ace’s Rules, named after a high school student-researcher in a DUS study. These rules include:

1. No one voice is privileged.
2. Everyone should have the space to speak, but speaking is voluntary.
3. What is discussed in the group stays in the group unless permission is given by all participants to share the discussion with others (Martin et al., 2006, p. 716-7).

These rules provide a structured form for discourse, which enables classroom participants the opportunity to negotiate individual roles and responsibilities in the classroom. One of the main ways cogenerative dialogues differ from focus group interviews is that “the questions in a focus group are carefully predetermined and sequenced [by the researcher]” (Krueger & Casey, 2009, p. 7), while the conversation topics during cogenerative dialogues emerge as the participants initiate and respond to each other’s comments.

A growing body of literature describes the benefits of using cogenerative dialogue as a methodology for collaborative classroom research. As a research tool, the researcher can gain useful data on the topics commonly discussed in cogenerative dialogues, which include social identity and relationship issues between classroom members, learning and teaching strategies, and power dynamics within the classroom. Additionally, cogenerative dialogue has been shown to ensure that classroom research meets Egon Guba and Yvonne Lincoln’s (1989) authenticity criteria, which require that research be ontological,
educative, catalytic, and tactical. By involving cogenerative dialogue in the methodological design, it allows for the research to be ontological in providing the opportunity for all participants to collectively examine their experiences in the classroom; it is educative in that it allows for participants to develop an awareness and understanding of others’ perspectives in the classroom setting; it is catalytic since it involves a forum for making decisions about how to transform the learning environment for the benefit of all classroom participants; and it is tactical in that it assists in ensuring that all participants benefit from the research by expanding the agency of all who are involved in the research process (Guba & Lincoln, 1989; S. N. Martin et al., 2006). Through these processes, cogenerative dialogues potentially have the added benefit of improving the teaching and learning in the classroom through this open forum for discussion.

The practice of cogenerative dialogue is explained by Kenneth Tobin, one of the leading educational researchers utilizing this method, as follows:

All participants in a cogenerative dialogue are encouraged to speak their minds, to identify specific examples to illustrate where improvements can be made, and also to identify examples of exemplary practices or counter examples of those that exemplify a need to change....Also, points that arise in discussion should be noted and, when actions are required, the group should come to an agreement on what is to be done and accept responsibility for enacting agreed to changes in the classroom (Tobin, p. 1).

Accordingly, in my dissertation research cogenerative dialogues served two purposes, the first of which was as a research tool to gain insight into the process of change in students’ environmental identity and their pro-environmental behaviors, and the second was as a potential method of improving the teaching and learning in the classroom. It was therefore critical to evaluate if and how the dialogues themselves affected the process of change. This evaluation was accomplished, as noted above, by observing and
interviewing both students that were directly involved in cogenerative dialogues and those who were not.

In the study setting, all students were invited to participate in cogenerative dialogues with the teacher, researcher, and other class members or administrators in varying combinations. Small groups were established according to lunch period of the student volunteers. Prior studies have found that a diversity of perspectives is critical for maximizing the potential of cogenerative dialogues. For example, in the LaVan (2004) dissertation stud, ‘The student researchers chosen differed in most respects including ethnic and family background, socioeconomic status, previous science and school achievement, social and symbolic capital with which they held with [the teacher], and their attitudes toward [the teacher] and school” (p. 31). Therefore, class members were assigned to a group with a “dialectical opposite” regarding the students’ role in the classroom whenever possible. The groups met once a week starting in the fifth week of the semester, in order to discuss what was working/not working for the students and the teacher, how they were experiencing the process of change, if at all, and how to improve the classroom culture and teaching strategies to better promote development of students’ environmental identity. Unfortunately, midway into the semester, after the cogenerative dialogue groups had met 2-3 times each, the school changed the lunch schedule and all of the dialogue groups were affected. After this, a single group of three students, the teacher, and the researcher met approximately every other week for the remainder of the semester. All cogenerative dialogues were videotaped to allow for later transcription and analysis.

By engaging with students and the teacher in these small group discussions, the researcher was able to gain valuable insight regarding social interactions amongst
classroom members, learning and teaching strategies, and power dynamics in the classroom, as well as how various activities were cognitively and emotionally influencing students' environmental identity and their pro-environmental behavior. Through open discussions about the learning process, cogenerative dialogues also provided a space to learn from the teacher and students what was working and not working for them in the classroom, and what classroom structures were perceived as affording or prohibiting learning from occurring. As mentioned above, segments of videotape from class were occasionally shared with students, and students were asked about their responses to that particular event that had occurred in the classroom, as well as what the larger impact on them might be from this type of experience, if any.

These methods—participant observation, videotape, formal interviews, and cogenerative dialogue—were chosen because they allowed for a sociocultural exploration of the process of change in students' environmental identity and pro-environmental behaviors. As mentioned in Chapter 1, the sociocultural framework serving as the basis for this study places activity at the center of all interaction as the unit of analysis, in this way viewing learning as a process mediated by social interaction. By focusing on activity, this allowed the researcher to explore structures on multiple levels, including those layers of interaction which were visible through observation, and also those layers involving participants' thoughts and feelings that had to be explored more deeply.

Survey Instruments

In addition to these qualitative methods, a survey was given to students in a pre/post format at the beginning and end of the semester to measure the change in students' environmental attitudes and behaviors. This research utilizes an established
survey for measuring environmental attitudes, the New Environmental Paradigm (NEP) scale (Dunlap, Van Liere, Mertig, & Jones, 2000), in order to measure attitudinal change over the course of the semester. This scale is a revised version of the earlier New Ecological Paradigm scale originally established in 1978 by Dunlap and Van Liere. The revisions are intended to update the earlier version to account for current conceptualizations of how we view the environment. Dozens of studies in several countries were conducted with the original NEP scale, mostly in general population studies, but also with specific groups of students and ethnic minorities. The current version of the NEP scale is a 15 statement Likert scale survey with alternating statements in the “pro-environmental/pro-anthropocentric” direction regarding balance of nature, limits to growth, human domination of nature, and ecological catastrophes. Examples of survey statements include “Humans have the right to modify the natural environmental to suit their needs” (human domination) or “Plants and animals have as much right to exist as humans” (balance of nature) (Dunlap, et al, 2000). In the study reporting the validity and reliability of the NEP scale, the authors suggest that the NEP scale can be used as “a measure of endorsement of a fundamental paradigm or worldview, as well as of environmental attitudes, beliefs and even values” (Dunlap et al., 2000, p. 427). They state that a set of beliefs or attitudes about the environment constitutes a “paradigm or worldview,” and that a high score on the NEP scale reflects a “proenvironmental orientation” or “ecological worldview” (Dunlap et al., 2000).

In order to measure environmental behavior, it was more difficult to locate a previously-tested survey that would be relevant for this group of students. Although many studies have attempted to measure behavior, often the behavior measure is a self-
report that has been created around whatever behavioral elements a course or program is emphasizing, and is therefore specific to that study. One of the more recent ways of measuring “pro-environmental” behavior is through an ecological footprint survey—these have become more common as people have become concerned with personal impact on the environment. In this dissertation study, behavioral change in students was measured by a survey based on the Zerofootprint: Kids Calculator, which is an “ecological footprint” providing information about the students’ pro-environmental behavior (www.zerofootprintkids.com/kids_home.aspx). The Zerofootprint: Kids Calculator provides a thorough range of questions geared towards children still living at home—many questions are focused on behaviors that a child could feasibly change, such as turning off lights, computer, television, etc. This survey instrument was first used during the pilot study, which is presented in Appendix A, during which validity and reliability of the instrument were established. Validity for this instrument was established by consulting other experts in the field to review the survey, and monitoring how the survey was being perceived and understood by students during the administering of the survey.

In order to establish test-retest reliability for the behavior survey, there were 30 questions on this portion of the survey given to the students; however, only 15 of them were actually elements that a high school student could feasibly change. For example, questions asking about whether or not the student has a pool, how many loads of laundry the family does, etc, were unlikely to change. The 15 potentially changeable items were regarding things such as turning off light or the television, recycling, how a student traveled to school, etc. By correlating the 14 “non-changeable” items on the pre- and post-tests for all students, it was possible to determine the reliability of the survey, which
was found to be 0.752 (p<0.05) in the pilot study with 257 participants. (See Appendix A for more details.) The 15 “changeable” items were used to calculate the ecological footprint of each student on the pre- and post-tests.

The same pre- and post-test survey was given to all students, and consisted of two sections: (1) 15 Likert-scale questions scored from 1-5 (5 being the most proenvironmental orientation) from the New Environmental Paradigm (NEP) scale that measure environmental attitudes (views about humanity’s ability to upset the balance of nature, the existence to limits of growth for human societies, and humanity’s relationship with the rest of nature), and have been previously tested for validity and reliability (Dunlap et al., 2000); and (2) 30 questions from the Zerofootprint: Kids Calculator, an “ecological footprint” whose language has been modified for appropriateness for 10-12th grade students in order to provide information regarding students’ environmental behavior (scores range from 5-35). The behavior scale has the lowest score indicating the least impact on the environment, while a high score indicates a relatively larger “ecological footprint.”

The surveys also included a section with questions about basic demographic information. The surveys served two functions, the first of which was to help with selecting students of diverse backgrounds and academic levels for formal interviewing and participation in cogenerative dialogues, and the second was to have a means of comparison at the end of the semester on these measures. Additionally, the post-survey given to students at the end of the semester contained a question aimed at collecting data on student perceptions of the most influential activities they experienced in the class. Three students and the teacher helped create the list of twenty-four significant activities
that the class participated in during the semester. The survey asked students to rank the three experiences that had influenced them the most with a “1”, “2”, or “3.” For each of the activities, student rankings were translated into scores where a ranking of “1” received 3 points, a ranking of “2” received 2 points, and a ranking of “3” received 1 point. Therefore, the higher the score for the activity, the more influential students perceived it to be. Students were asked during the first and third interviews to explain why they had chosen certain options on the attitude or behavior survey, as well as during the third interview why they had ranked activities as they had on the post-survey question.

**Research Setting**

A pilot study was conducted in the first phase of this research project in order to locate Environmental Science teachers who were affecting change in their students’ environmental attitudes and behaviors. Ten Environmental Science teachers and eight “non-environmental” science control teachers and their students (N = 257) participated in the study, which is presented in full detail in Appendix A. From the results of the pilot study, three potential teachers/classrooms who had affected change in either their students’ environmental attitudes or behaviors were identified as potential research sites for this study. Of these three sites, the site was chosen for the study based upon the teachers’ willingness to participate, a diverse socioeconomic student population, and proximity to the research university for accessibility purposes. The site chosen was a public high school in the Northeast. The school is located in a suburban neighborhood, but is attended by students from rural areas as far as an hour and a half away. The high school serves 1700 students with 23% eligible for free or reduced lunch. In 2006, the
school had an 80% graduation rate, with 38.1% of students going on to four year colleges or universities, and in 2007, 101 students dropped out of school, representing 6% of the student population (http://www.city-data.com).

**Participant Involvement**

The participants in this study were 10-12\textsuperscript{th} grade high school students (N = 17) in an Environmental Science elective course, as well as their teacher, referred to in this study as Mrs. P. The class was considered the lower level of two Environmental Science classes offered at the school, and many students enrolled in the course due to the perception that it was an easier alternative to chemistry. Students had varying levels of participation in the study on a voluntary basis, including participation in the class, surveys, interviews, and/or cogenerative dialogues.

During the first week of class, all students were asked to be participants in the study and to sign an IRB approved consent form ensuring that they understood the premise of the study and the voluntary nature of their involvement. Students who were minors were required to have parental consent as well. Students were also notified that they could choose to discontinue participation at any time over the course of the research project. After consent was obtained during the first week of the semester, students were given the attitude and behavior surveys, which included a section with questions about basic demographic information.

After two weeks of participant observation and initial videotaping of class, all students in the class were asked to participate in three formal interviews over the course of the semester that would take place during lunch time. Ten students volunteered to be interviewed, and all of them participated in the first round of interviews. These students
represented a diverse sampling based on gender, achievement level, classroom involvement, social group in the class, and answers on the surveys. As mentioned above, seven students were interviewed three times during the semester (beginning, middle, and end), while three students were interviewed twice, and one student only once. The eleventh student expressed an interest in being interviewed midway through the semester, and therefore was interviewed during the second and third interviews. Student interviews lasted approximately 30 minutes to an hour. The teacher was also formally interviewed three times during the semester with interviews ranging from 70 minutes to 90 minutes.

During the fourth week of the semester, students were asked to volunteer to participate in cogenerative dialogues that would meet once a week during lunch. As explained above, small groups were formed according to lunch schedule and by assigning each student to a group with another student who could be considered a “dialectical opposite” in their role in the classroom. Overall, eight students participated in cogenerative dialogues over the course of the semester. Originally, three groups were formed, which met every other week. The teacher was present at meetings with one of the three groups. After 2-3 dialogues, however, the lunch schedule changed mid-semester, and groups had to be reformulated. Only three students were able to continue with the dialogues, and therefore there was only one group during the second half of the semester including the three students, the teacher, and myself, which met every other week. One student who participated in both the interviews and the cogenerative dialogues emerged as a “student researcher” who helped with video equipment and videotaping, as well as creating the activity survey which was attached to the original post-survey.
Data Analysis

Analytic Framework: Gee’s Discourse Analysis

According to Gee, “a discourse analysis involves asking questions about how language, at a given time and place, is used to construe the aspects of the situation network as realized at that time and place and how the aspects of the situation network simultaneously give meaning to that language” (Gee, 2005, p. 110). Since ethnographic field data involves various formulations of social interactions and individual ideas expressed through language, discourse analysis is critical to the process of making meaning from this data. The questions that Gee recommends asking of one’s data can be separated into seven different categories, each of which provides a piece of the full picture that one’s data can provide. This chapter highlights three of these categories that are the most relevant to this research, suggesting how the questions in that category pertain to this dissertation study and defining key terms used by Gee and their applicability to the analysis. Please note that Gee’s other categories were referred to in the analytic process as well and can be found on pages 110-112 of Gee’s An Introduction to Discourse Analysis: Theory and Method (2005); however, the other categories were not seen as central to the analysis. Some of Gee’s questions are aimed at revealing more context-specific meaning, while others are more circumstantial; these differences are highlighted as well.

1. significance

- What situated meanings and values seem to be attached to places, times, bodies, people, objects, artifacts, and institutions relevant in this situation?
What Discourse models seem to be at play in connecting and integrating these situated meanings to each other? (Gee, 2005, p. 110)

Gee explains that the meaning of any word or phrase is multiple and flexible, depending on the situation/context in which it is used. The “situated meaning” is grounded in actual practice and experiences (p. 53), and is based on our construal of the context and on our past experiences (p. 65). It is related to the value that we place upon different influences acting in our social world. This is relevant to the current research which investigates these values and influences as they pertain to students and the teacher in an Environmental Science class (context-specific). The relative value that participants place on the educational system, each other’s ideas, social interactions, cultural values (family, community), and the environment all have an impact on the process of change they are experiencing (circumstantial factors).

Another key term for Gee is “Discourse model” and by this he refers to “the largely unconscious theories we hold that help us make sense of texts and the world” (Gee, 2005, p. 71). They are often simplified and taken-for-granted, and are formed and changed as our experiences are shaped by the social and cultural groups to which we belong (Gee, 2005). These models are connected with our values, which are formulated as a result of the influences described above. Additionally, Discourse models are often influenced in our society by what Gee refers to as “Conversations,” defined as “themes, debates, or motifs that have been the focus of much talk and writing in some social group with which we are familiar or in our society as a whole” (Gee, 2005, p. 21). The “Conversation” that relates most directly to this dissertation research is that surrounding the theme of the “Environment.” Recently, there has been an increase in the discussion in
the media and amongst scientists, politicians, and the general population regarding global warming and the “energy crisis,” and what should be done about it. This study explores how these messages are affecting the student participants in the study. When they come to class, with what ideas and what alternative conceptions are they coming? Do they feel compelled to action by these messages or not? What are the most influential sources of information regarding their environmental ideas?

Discovering the underlying theories people hold regarding the environment is critical in determining how it is that people are able to change, or not change, their Discourse models on this topic. This research aims to determine what structures allow for and encourage students to change their views, theories, and actions towards the environment. One hypothesis investigated in the study is that helping students to become aware of their own theories about the environment will help them to critically reflect upon these ideas.

2. identities

- What identities (roles, positions), with their concomitant personal, social, and cultural knowledge and beliefs (cognition), feelings (affect), and values, seem to be relevant to, taken for granted in, or under construction in the situation?
- How are these identities stabilized or transformed in the situation?
- In terms of identities, activities, and relationships, what Discourses are relevant (and irrelevant) in the situation? How are they made relevant (and irrelevant), and in what ways? (Gee, 2005, p. 111)

The term "Discourse" refers to the ways of acting, interacting, feeling, believing, valuing, and using various sorts of objects, symbols, tools, and technologies to enact specific
identities and activities; in other words, to “pull off” being a culturally specific sort of person (Gee, 2005, p. 7). This idea is closely linked with Gee’s concept of “socially-situated identity,” which implies that each individual takes on a variety of identities in different practices and contexts (context-specific). In the case of doing research with teenagers, it is extremely important to examine how they view themselves as being parts of various Discourses, and how this view affects their environmental values and actions.

As discussed earlier, the roles of identity, emotion, and social norms are explored to see how these factors interact to influence the teenagers in this class. Of significance to this study is how students’ view the Discourse of an “environmentalist”—whether this is a Discourse with which they feel connected and are striving to enact, or one that they feel unconnected with or apathetic about. Also of interest is whether a student’s view of an “environmentalist” and the teacher’s portrayal of him/herself as such has an influence upon the likelihood of the student becoming more or less associated with this Discourse as part of her own identity.

Additionally, the concept of “environmental identity” is at the heart of this study. In investigating the environmental identity with which students enter the class, in addition to the factors influencing change in this identity, Gee’s questions listed above allow for exploration of the personal, social, and cultural elements that are affecting change, in addition to assessing which activities and relationships are relevant to the development of one’s environmental identity. Gee’s assumption that each individual takes on a variety of identities in different contexts is also useful in analyzing how environmental identity may interact with other aspects of an individual’s identity in the context of the Environmental Science classroom.
3. relationships

- What sorts of social relationships seem to be relevant to, taken for granted in, or under construction in the situation?
- How are these social relationships stabilized or transformed in the situation? (Gee, 2005, p. 112)

Given the sociocultural focus of this research, both student-student and student-teacher relationships are especially important focuses of the investigation. The value that students’ place on these relationships is likely to influence their engagement level in the Environmental Science classroom activities and discussions. Into this field of analysis, we could fit the circumstantial factor of “politics” where social goods, such as power, status, valued knowledge, positions, or possessions are negotiated amongst stakeholders (Gee, 2005, p. 84). In this research, it is critical to study the power dynamics that exist between the class members and the teacher (context-specific), and to examine how these dynamics may affect how students are influenced (or not) by the class. For example, it would be expected that a student that is well-respected by the teacher may be more affected by the class than one that is not. Additionally, issues of cultural incongruence, as discussed in the section of the Introduction chapter called “Culture, Fields, Structure, and Agency,” can lead to struggles between classroom stakeholders. From a sociocultural standpoint, it is therefore crucial to determine how these relationships are affecting the learning of the students.

The idea of agency is one that is closely associated with the power dynamics of the classroom. Gillian Bayne, introduced above, defines agency as “being able to access and appropriate structures/resources” (Bayne, 2008, p. 6). Her article also discusses the
importance of both individual agency and collective agency in creating a supportive classroom culture that moves towards meeting its goals. As such, this is an important concept to consider within an Environmental Science classroom where both individual and collective agency is likely to play a role in how students feel about their ability to “make a difference.” If students feel that they can access the resources they need to be heard and have a voice, then it would follow that they would be more likely to partake in pro-environmental action.

A related concept in the environmental education literature is that of self-efficacy, which is defined as “the confidence that individuals have in their ability to plan and execute a course of action and to accomplish a task or solve a problem” (Meinhold & Malkus, 2005), and is closely related to internal locus of control. A person is said to have an internal locus of control if she feels her own actions will produce an intended outcome, while she has an external locus of control if she feels that outside forces outside of her control produce outcomes. The relation of self-efficacy and internal locus of control to environmental action makes sense intuitively, and several studies have shown this correlation (Hwang et al., 2000; Meinhold & Malkus, 2005). In terms of its relation to sociocultural experiences, it could be hypothesized that if a person feels empowered during these activities (has a sense of agency), then this would lead to an internal locus of control, whereas if she feels helpless, out of control, or taken advantage of (lacking agency), then this would lead to an external locus of control. It would follow as well that the empowered person would be more likely to carry out pro-environmental actions.

In summary, the issues of meaning, identity, and relationships in the context of classroom activity are central to this research. Therefore, these themes and questions
presented in Gee’s *An Introduction to Discourse Analysis: Theory and Method* (2005) not only served as a guide during data analysis, but also as a framework in all forms of data collection, including the decisions of which activities to videotape, what questions to ask during interviews, and which segments of video or topics to discuss during cogenerative dialogues. The manner in which Gee’s themes and questions were used in the data analysis process is discussed more explicitly in the following section.

The Process of Data Analysis

The task of data analysis was an ongoing process during this research study. Participant observation yielded daily field notes that contained both reflective and reflexive components. Interview transcripts were generated throughout the course of the semester, and reviewed to allow for important and interesting areas of investigation to emerge early in the research process. Topics of interest discovered from field notes and interviews and as a result of ongoing video analysis were utilized to choose vignettes and topics for discussion during cogenerative dialogues. The different forms of data collection therefore informed each other at all stages of research.

In order to document the process of change in students’ environmental identity and pro-environmental behavior, several techniques for analysis were used to ensure the rigor of qualitative research, including multiple data sources, multiple levels of analysis, code checking with other qualified researchers, as well as member checks with the teacher and several of the student participants in the study (Creswell, 2003; Guba & Lincoln, 1989). Analysis of the data occurred in several stages, beginning with analysis of the student and teacher interview data using NVivo 8 software. Open coding was originally used to generate codes and categories. Through this process, three general
areas of interest emerged that became the topics of the three results chapters, Chapters 3, 4, and 5, of this dissertation. These general topics included (1) factors affecting the process of change in environmental identity and pro-environmental behavior for individual students during the semester, (2) how various activities in the course interacted with classroom structures to affect students’ environmental identity, and (3) the teacher’s goals for the course and students’ reactions to the enactment of these goals. Each of these topics then required a further in depth analysis aimed at creating themes and subthemes under the topic being explored.

The data analysis for Chapter 3, which focuses upon factors affecting the process of change in environmental identity and pro-environmental behavior for individual students during the semester, began with another round of open coding of the student interview data. Several themes emerged which were common across the different students, including: (a) environmental background, (b) openness to new environmental information, (c) thinking critically about environmental issues, (d) environmental behavior coming into class, (e) changes in environmental behavior, (f) ideas about environmentalism, (g) attitude towards school, (h) relationship with the teacher, (i) relationships with peers, and (j) how the student was influenced by the research.

Next, “focused coding” (Charmaz, 2006) and continual comparative analysis was performed with the three interviews for each of the 10 students interviewed. Subthemes then emerged within the categories listed above. For example, within the category of “changes in environmental behavior” subthemes emerged related to changes in reasons for environmental behavior; changes in small, daily tasks (such as leaving the tap water on less while brushing teeth); more significant changes in more culturally-embedded
behavior (such as reducing one’s eating of meat). For each of the seven students who had been interviewed three times, a “storyline” was developed according to the themes and subthemes documenting the process of change in the student’s environmental identity and associated behaviors over the course of the semester. Four of the seven students who represented different types of changes in their pro-environmental behavior were chosen as the main focus of Chapter 3.

Analysis of the data for Chapter 4, which was focused on how various activities in the course interacted with classroom structures to affect students’ environmental identity, began with “focused coding” (Charmaz, 2006) of the student and teacher interview data using NVivo 8 software. Focused coding was used to develop categories of activities that were discussed during the interviews. These categories included such activities as: documentaries, mock town meeting, class debate regarding the Alaskan National Wildlife Refuge (ANWR), etc. Next, subthemes within the activity categories were generated by coding the data using questions from Gee’s An Introduction to Discourse Analysis: Theory and Method (2005) as a guide. Specific questions under Gee’s categories of Building identities, Building relationships, Building politics (the distribution of social woods), Building connections, Building significance for sign systems and knowledge (pp. 111-112) were deemed critical based on the theoretical framework of the study. Examples of these questions, which were used as a guiding framework for coding, include: (1) “What identities (roles, positions), with their concomitant personal, social, and cultural knowledge and beliefs (cognition), feelings (affect), and values, seem to be relevant to, taken for granted in, or under construction in the situation?” (2) “What sorts of social relationships seem to be relevant to, taken for granted in, or under construction
in the situation?” (3) “What social goods (e.g. status, power) are relevant (and irrelevant) in this situation?” and (4) “What systems of knowledge and ways of knowing are relevant (or irrelevant) in the situation?” For most of the activities, the subthemes that emerged included the aim/purpose of the activity from the teacher’s perspective; the effect of the activity on students’ environmental and consumer-materialist identity; social interactions that made the activity successful or compromised; and student interaction with the source of the content for each activity. Seven major activities were chosen to be the focus of Chapter 4, and the four subthemes above form the structure of the discussion in that chapter.

The analysis for Chapter 5 was focused upon the teacher’s goals for the course and students’ reactions to the enactment of these goals. Analysis began with “focused coding” (Charmaz, 2006), which was used to determine categories of objectives that were discussed by the teacher throughout the three interviews. The categories that emerged included (1) environmental awareness, (2) student empowerment, (3) sense of place, (4) presenting a balanced perspective, (5) influencing students’ behavior, (6) critical thinking, and (7) evoking emotions. Next, student interviews were reviewed and coded according to the above categories, and student reactions to the teacher’s objectives were clearly noted. Chapter 5 presents each of the teacher’s goals in the above categories and student responses to these goals as they were experienced in the classroom.

For each of the above analyses, themes and subthemes were coded for accuracy by a fellow graduate student in the education department to ensure reliability of the coding procedure. There was a 98% overlap in the distribution of codes, and the final 2% were discussed and negotiated. Additionally, the videotapes of the cogenerative dialogues
were viewed during a meso-analysis at regular speed, while recording a chronology of topics being discussed. Segments that served to substantiate or contrast with findings in the interview data were noted. During a subsequent micro-analysis, these vignettes were transcribed verbatim, and coded according to the emergent themes and subthemes described above. Several subthemes were added under the themes of peer-peer interactions and teacher-student interactions in the analysis for Chapter 3, including subthemes regarding leadership in the class and views of the teacher depending on whether she was perceived as being either one-sided or balanced in her presentation. The latter also became a major theme in Chapter 5. Another subtheme emerged under the larger theme of "critical thinking about environmental issues," which was whether students' felt a connection with national or global environmental issues being discussed in class. This also became a subtheme under the Class Discussion category in the analysis for Chapter 4. Additionally, field notes and classroom videotape were reviewed continuously to explore both agreement and discrepant observations between data sources.

Finally, the structure and theoretical framework of the symbolic interactionist theories of emotion and the development of environmental identity enhanced the stages of analysis by providing a common approach in the comparative analysis of the students' experiences. This theoretical framework along with all the data forms has been utilized to produce rich description, narratives, and vignettes with the goal of providing answers to the study’s four topical questions regarding the process of change experienced by students in the Environmental Science classroom. This report of the data allows readers to “witness” the influences upon the learning process through the accounts of the teacher.
and students themselves. The students whose interviews were chosen for use in this paper as well as the teacher were asked to review the chapter(s) describing the results relating their experiences. Participant checks were completed with the teacher and three out of the four students, who are the focus of Chapter 3, to ensure that they did not feel misrepresented by my interpretation. Any concerns expressed by the teacher and the students were carefully considered.

**Managing Bias**

Managing one's own biases and subjectivity in all research is essential to producing credible results. Inevitably, biases affect the research process from the initial stages of formulating research questions to one's interpretation and defense of the dissertation. Writing on the topic of subjectivity in his article "In Search of Subjectivity—One's Own," Peshkin writes,

"The point I argue here is that researchers, notwithstanding their use of quantitative or qualitative methods, their research problem, or their reputation for personal integrity, should systematically identify their subjectivity throughout the course of their research" (Peshkin, 1988, p. 17). Peshkin emphasizes that we as researchers have a responsibility to identify our biases, make our readers aware of them, and attempt to eliminate them as best we can. By being open about our biases, we can provide an honest framework by which others may read and interpret our description and analysis. Erickson (1984) makes the goal clear in his article, "What makes school ethnography 'ethnographic'?" when he writes, "The desirable goal is not the impossible one of disembodied objectivity...but of clarity in communicating point of view...both to myself and to my audience" (p. 60).
With this goal in mind, below is an in depth description of my own ideas entering into this research project regarding the path a person takes to become environmentally responsible. This description was a preliminary account of my ideas going into this research project. In conducting the research, I attempted to put aside my own views in order to capture the different approaches that students might be taking. I did think that it was critical, however, to lay out my own ideas as a reference going into this research, as a first step in monitoring by own biases. I have continued to monitor my own influence on the research throughout the research process.

**An Environmentally Responsible Person**

In this section, I describe my vision of how one becomes environmentally responsible. I have divided my definition of an environmentally responsible person into four main characteristics, each of which is explored further below. In this vision, an environmentally responsible person will:

1. **"Be present"** in order to be aware of one’s own actions
2. Use one’s understanding/knowledge to think critically about one’s own actions
3. Develop an “environmental conscience” in one’s decision-making
4. Be compelled to utilize one’s “environmental conscience” and act on what one determines to be the “best” action from numbers 2 and 3 above.

In order to understand the meaning of the first characteristic in an environmental context, it is helpful to consider Thich Nhat Hanh’s Buddhist ethic and the idea he articulates as “being present” in order that we may be mindful. There is a notion discussed in his book, *Being Peace*, called “being awake” (Hanh, 2005), which is a critical notion for environmental awareness. Thich Nhat Hanh tells us:
“In Buddhism, the most important precept of all is to live in awareness, to know what is going on. To know what is going on, not only here, but there. For instance, when you eat a piece of bread, you may choose to be aware that our farmers, in growing the wheat, use chemical poisons a little too much…” (Hanh, 2005, p. 68-9).

He goes on to give several other examples, including being aware of the hunger in the world, the impact of eating meat, how many trees go into a Sunday newspaper, and the impact of cars on the environment. He says we must be aware in the present moment of our lifestyle and our consumption habits. This section concludes, “If we are very aware, we can do something to change the course of things” (Hanh, 2005, p. 69). I would like to add the word “only” before this quote to emphasize its necessity—only if we are very aware, can we do something to change the course of things. I do not think we can overstate the importance of this statement in the transformative process involved in environmental education.

Many of us carry out many environmentally harmful actions out of habit— for example, using paper towels to dry our hands, buying our favorite brands despite excessive packaging, using to-go cups instead of bringing a travel mug, leaving the tap running while brushing our teeth, leaving the TV, computer, or lights on, driving when we could walk or take the bus, etc. The first step in changing any of these habits is the awareness that we are doing them, that they are environmentally harmful, and that there are simple alternatives. If we do not think about our actions in this manner, if we are not “awake,” then it is not possible to change. Of course, we must combine being present with other components of an environmentally responsible person to truly bring about the type of deep transformation and commitment to environmental action that is desired.
The second characteristic above refers to what we might call “environmental knowing.” We can begin to understand this phrase by turning to Jack Mezirow, one of the originators of transformative learning theory, who suggests that in learning new content, it is not sufficient to gain a conceptual understanding of this new material; rather, in the process of doing so, the learner should become “(1) more aware and critical in assessing assumptions – both those of others and those governing one’s own beliefs, values, judgments, and feelings; (2) more aware of and better able to recognize frames of reference and paradigms (collective frames of reference) and to imagine alternatives; and (3) more responsible and effective at working with others to collectively assess reasons, pose and solve problems, and arrive at a tentative best judgment regarding contested beliefs” (Mezirow, 1997, p. 9). The process of learning new knowledge is seen to be an active process, rather than a passive one, in which the learner is engaged in critical reflection during the learning of new knowledge.

The discussion of Cobern (1996) is also informative on this subject, differentiating between comprehending new content, and apprehending it as knowledge. Cobern explains that a student with a conceptual understanding of new information may learn this material for a test, but they may “simply wall off the concepts that do not fit their natural way of thinking. In this case, the students create a compartment for scientific knowledge from which it can be retrieved on special occasions, such as a school exam, but in everyday life it has no affect” (Cobern, 1996, p. 588). This student is comprehending the new concepts, but is exhibiting what Cobern refers to as cognitive apartheid, in not accepting this knowledge into her way of knowing about the world, i.e. not apprehending this knowledge. Cobern suggests that in order to bring about apprehension we need to
address the presuppositions in the worldview of students in order to truly bring about an acceptance of the new material and its utilization in decision-making processes (Cobern, 1996). Having students critically reflect upon their own underlying assumptions, then, is important in both Mezirow and Cobern’s description of how one learns ‘knowledge.’

In the field of environmental education research, there are very few studies, if any, that consider ‘knowledge’ from this critically reflective standpoint. The survey studies measure ‘knowledge’ through a variety of content items, which are mostly unreported. The information we have about the role of knowledge in environmental education can only be inferred from these studies, which are trying to assess the relationship between environmental knowledge, attitudes, and behaviors, which has been found to be a tenuous relationship at best (Hwang et al., 2000; Kuhlemeier et al., 1999; Meinhold & Malkus, 2005). These studies do not address what type of knowledge, or what the role of critical reflection is in bringing about changes in environmental attitudes and behaviors.

From my own experience in teaching Environmental Science, I have found that it is necessary for students to have a foundation in the principles of ecology in order to understand more complicated environmental issues. Students must be taught about the interconnectedness of nature, which is a holistic view, but also a scientific one. The principles of ecology teach us about food chains and food webs, recycling of nutrients in the environment, the carbon, water, and nitrogen cycles, the related processes of photosynthesis and cell respiration, and most recently the interdependence of the global climate. Without this background knowledge, students will not realize the impact of human actions, and specifically their own actions, upon the environment. Therefore
knowledge is viewed in the pragmatic sense described by John Dewey in *Democracy and Education: An Introduction to the Philosophy of Education* (1916), whereby knowledge is valued by its “applicability to what is still going on, what is still unsettled, in the moving scene in which we are implicated” (p. 250). Much of what is considered “knowledge” has come as a result of thinkers in the past, but unless this subject matter can be applied in the individual’s own life, it ceases to be “knowledge” for that individual. Knowledge, then, must always be grounded in present experience. Dewey agrees with Mezirow and Cobern that this should be an active learning process, rather than a passive one, during which critical reflection is always taking place (Dewey, 1916).

Thich Nhat Hanh in *Being Peace* discusses the importance of being open to new knowledge, understanding, and alternative possibilities. According to Hanh, many of us cling to our views and knowledge, and this makes it very difficult to change, or transcend, our ways of living. The Buddha says, “If you cling to [the supposed truth] so much, when the truth comes in person and knocks at your door, you will not open it” (Hanh, 2005, p. 49). This is extremely important in the development of an environmental conscience because we must accept that we do not have all the answers—we have to practice listening not only to other people, but to Nature as well, in order to guide our actions. Thich Nhat Hanh argues that knowledge “blocks the way of understanding” (p. 49) when it limits our ability to listen, be aware, and transcend. I would argue that we need knowledge in order that we are not ignorant, but we need knowledge in the sense of Buddhist understanding and Deweyan pragmatism, so that we are not blindly committed to what we have been taught are universal, scientific truths.
The third characteristic listed above is the development of an “environmental conscience.” This term was originally used by Aldo Leopold in his now famous *A Sand County Almanac*, but I would like to further define it here. The term conscience itself is defined as “the sense or consciousness of the moral goodness or blameworthiness of one’s own conduct, intentions, or character, together with a feeling of obligation to do right or be good” (Merriam Webster’s Online Dictionary, [www.merriam-webster.com](http://www.merriam-webster.com/dictionary)). I would argue that this consciousness does require a pro-environmental ethic (‘ecocentric’ or ‘wise-use’), but more importantly, it is learning to look at our actions in a certain way. When one is using an “environmental conscience” it seems to me that this person is actually considering a range of possible actions around the task at hand, and in deciding which of these alternatives to pursue, is considering the environmental consequences of the action, as she can best determine. Paul Taylor explicates this idea of considering alternative actions through the use of a principle called *The Principle of Minimal Harm*, which is stated as follows:

> Actions that pursue certain nonbasic human interests are permissible even when they aggress against the basic interests of (wild) animals and plants provided that they are compatible with the attitude of respect for nature and provided that no alternative way of pursuing those nonbasic human interests would involve fewer wrongs. (cited in (Sterba, 2001, p. 36))

This principle suggests that we must consider alternative ways of meeting our non-basic needs and wants, and the action to pursue is the one that involves the fewest wrongs not only to other people, but to nonhuman nature as well. Interestingly, this principle could be applied by people with a “wise-use” anthropocentric ethic or an ecocentric ethic because rather than emphasizing why we need to consider the environment in our decision-making, its emphasis is on how to make these types of decisions. Being able to
make this assessment regarding the "fewest wrongs" is largely dependent on an understanding of ecological principles and the Earth's interconnected systems, as mentioned in the second characteristic above. With this knowledge/understanding, the decision will be based on our best assessment of consequences, which therefore has a clear connection with Mill's consequentialist philosophy. The difference, however, is that the decision is no longer based simply on the best outcome for humanity, but encourages us to take into consideration different alternatives and determine what will cause the least harm to the environment using our own judgment.

Let us consider how the consideration of alternative actions, such as is advocated by the Principle of Minimal Harm, works in an everyday situation – that of driving our car somewhere for a leisure activity (a non-basic need). If we are exhibiting an "environmental conscience," we will be aware that this action may have negative effects on the environment, and will therefore consider possible less harmful alternatives—for example, we could choose to go somewhere closer, we could choose to carpool to reduce our impact, we could choose a place we could get to by public transportation, or we could choose not to go at all. The first two are possibilities that many of us are considering with the cost of gas rising daily, but they are also less harmful to the environment. The second two may be either not possible or not desirable, but in some cases they may be. If this particular activity is one in which we have a strong desire to participate (taking into account our own happiness), then perhaps carpooling is our best option. This decision-making process is utilizing an environmental conscience.

I would now like to discuss whether the consideration of alternative actions can be applied to humans' basic needs—food, water, air, clothing, shelter. Let's look more
closely at the possibilities around shelter. If we consider the alternatives for providing humanity with housing, then this leads us to the realization that many of us live in houses well beyond our needs. In making housing decisions, we should consider alternatives, such as living close to our jobs or close to public transportation, how much space we truly need to live well, whether we need a lawn, and/or if it is feasible to have a garden and compost area to sustainably grow our own food, and to recycle our own food scraps. Applying this decision-making process to other issues such as clean air, water, and food leads to similar resolutions, resulting in policies that allow for human needs to be met through methods with least harm to the environment. It seems, then, that a consideration of alternative actions, as is recommended by the Principle of Minimal Harm, is a helpful guide in decision-making regarding our basic as well as our non-basic needs.

One of the critiques of this type of decision-making process whereby each individual is considering alternative actions is that because the specific outcome is left to be defined by each individual, a person may not choose the option that an ‘expert environmentalist’ would choose. This may be due to a lack of knowledge/understanding or because of different priorities. This is why we must help individuals develop knowledge/understanding (characteristic 2 discussed above), and develop the motivation to act and choose the action with the least harm to the environment (characteristic 4 discussed below). If individuals are doing their best to utilize the knowledge/understanding that they possess and to enact what they determine to be the “best” alternative action taking the environment into consideration, then they are exhibiting the characteristics of an environmentally responsible person.
I would like to make it clear that this is the type of thinking process that I find myself using in my own environmental decision-making, but it may not be what is used by others. Part of the proposed research involves exploring if and how students in the Environmental Science class begin to develop an environmental conscience and what this means to them.

The final characteristic involves being compelled to utilize one’s “environmental conscience” and act on one’s decision based on her environmental conscience. The issue of what drives us to think and act in certain ways is complex, and I may find a whole host of factors as a result of this study. Two factors that I am aware of at present, and that merit a brief discussion are (1) a “sense of duty,” connected with a sense of responsibility, and (2) an emotional connection with nature that may lead to an ethic of care. The first of these was discussed by Immanuel Kant, who believed that it is a sense of duty propelled by an individual’s good will that determines one’s moral actions. Our good will leads us to “Act only on that maxim whereby thou canst at the same time will that it should become a universal law” (Kant, 2005, Original 1785, p. 38). Also known as Kant’s categorical imperative, its application relies on the faculty of reason that each rational human being possesses. He leaves it to the individual to apply this imperative through her own use of reason to determine a priori what her “good will” commands, and expects that she will follow this imperative and the principles it suggests out of duty, which is “the necessity of acting out of respect for the law” (Kant, 2005, Original 1785, p. 16). These ideas could be related to an individual feeling compelled to utilize an “environmental conscience” in one’s decision-making, if a person has a sense of duty and is including consideration of the environment in determining what should become a
universal law as a guide to one’s actions. I have often heard people say that they feel “a sense of responsibility” towards protecting the planet either because they value the natural world or for future generations. These feelings seem to invoke a commitment to environmentalism that is being motivated by a sense of duty, although this does not explain why some people feel a sense of duty towards the environment, while others do not. However, this question may be more in the realm of the superego, which is a level that is very difficult to explore, even within ourselves.

While some people cite rational reasons for acting in an environmentally responsible manner, others describe more of an emotional attachment towards the environment, which has led to an ethic of care. The importance of an ethic of care as a framework for morality has been recommended by Nel Noddings, who suggests that the caring relation emphasizes reciprocity, in the sense that both parties must be involved and responsive to the other (Noddings, 2002). While Noddings uses this description to describe caring relations between people, it has been suggested that this idea can be extended to a relation of “caring for” Nature. For example, if we learn to pay “receptive attention” to Nature’s needs, and we think about and attempt to understand the needs of that which is being cared for, then this can have a significant impact on our interactions with Nature. In his article, “Caring for the Environment: Challenges from Notions of Caring,” Peter Martin states that “proximity is the most powerful determinant of caring behaviour and is a precursor to relatedness” (Martin, 2007, p. 59). He points out that most young people feel separate and distant from Nature, and at best can be taught to care about Nature, unless environmental education puts a high priority on direct personal contact so that students can learn to care for their local environment. Martin recommends
emphasizing activities where children can experience responsiveness to and from Nature—whether this is working with animals or tree planting, etc.—making this a truly caring relation. In the proposed study, I will be investigating whether students are given the opportunity to develop this type of relation with their local environment, whether the focus is on caring about Nature or caring for Nature, and how students respond to these experiences. Interestingly, the reasons for motivation tend to operate at a subconscious level, and whether these reasons are more in the realm of rationality, affect, or a different domain, discovering these reasons may require some deep probing in order to reveal what is truly driving or preventing our students from becoming environmentally responsible.

In collecting the data for this research, I had no control over the teacher’s goals and objectives for the course and little control over the curriculum and direction in which the class progressed. In order to document the teacher’s goals for the course, Mrs. P was asked explicitly during the first and third interviews about her overall goals for the course, and if and why she perceived that they were being met (or not). During all three interviews, she was also asked about her objectives in including various activities within the curriculum. These goals and objectives are presented in Chapters 4 and 5. Students’ perceptions of how these goals were enacted in the classroom, and their reactions to the goals are explored in Chapter 5 as well.

Throughout the research, I never expressed my views about the goals for the course; however, I did recommend various activities to the teacher that had been effective with students during my previous teaching experiences. These activities were always based on themes decided by the teacher. The only two that I took an active role in planning were taking the students outside to core a tree and collect basic tree data, and
planning the mock town meeting. It is possible that my bias towards taking students outside and encouraging critical thinking regarding local issues played a role in my suggestion of these two activities. However, they were immediately taken on by the teacher, fully incorporated into the curriculum, and enacted through her vision.

The description above of an environmentally responsible person played little, if any, further role in the research. The teacher was asked about her conception of an environmentally responsible person during her third interview, and her response was related to her goals for the class, which are thoroughly reported in Chapter 5. At no point during the research did I discuss my views of the progress of the class with the teacher (see Role of the Researcher section below). While I did not consciously attempt to steer students down a certain path, it is possible that my environmentalist slant came through in conversations with students on a few limited occasions, one of which was during interviews or cogenerative dialogues when students inquired about my reasons for being a vegetarian (which I answered honestly). The other time occurred when I presented the power point to the class on the environmental issues in Costa Rica and Panama, and I emphasized the role of cattle ranching in destroying the rainforests in that region because that was a topic being discussed in class. Overall, however, on an informal survey given to students at the end of the semester, on a scale of 1 to 10, students rated the researcher on average as having a bias of 7 (1 being the least biased, 10 being the most biased), while the teacher was rated as having a bias of 9, on average.

In my data collection and data analysis, my objective was to describe what transpires in the classroom and record the students' perceptions of experiences as accurately as possible. Through the use of audiotape and videotape procedures during
participant observation, interviews, and cogenerative dialogues, data was collected
directly from the participants, in their own words and through their own actions. This
multiplicity of data collection forms provided a manner of triangulation in looking for
agreement and contradictions within the data. Additionally, by having multiple persons
involved in the coding process and in participant checks, this added another layer of
reliability to the research process. The participant checks with the teacher and student
participants also ensured that they did not feel misrepresented by my interpretation.

**Limitations of the Research**

There are several limitations to this research methodology that are important to
discuss. These include the limited role of cogenerative dialogue in the study compared
with the intention; the lack of generalizability of the study findings; and the inevitable
limits of being unable to be completely objective as a researcher due to the influences of
my own background and experiences.

**The Role of Cogenerative Dialogue**

In this dissertation study cogenerative dialogues were to serve two purposes, the
first of which was as a research tool to gain insight into the process of change in students’
environmental identity and their pro-environmental behaviors, and the second was as a
potential method of improving the teaching and learning in the classroom. One of the
original topical research questions for the study related to this second purpose: *What, if
any, influence does cogenerative dialogue have on the sociocultural structures in the
classroom? Does cogenerative dialogue influence the instructional beliefs and teaching
methodology of the teacher and if so, how?* This question is not included as a topical
question in the current description of the dissertation project, however, due to several
issues (discussed below) that arose with implementation of the dialogues that made it difficult to effectively pursue an answer this question.

In actuality, the logistics of implementing the cogenerative dialogues proved difficult due to the challenges of scheduling within the school day. The only feasible time for dialogue meetings was during the lunch periods, which were only 30 minutes long. By the time all members arrived and were settled, this often became shortened to 25 minutes of dialogue. Additionally, the regularity of the cogenerative dialogues was interrupted by a school-wide schedule change in the student lunch periods, which was when the dialogues were held. By the mid-point of the semester two cogenerative dialogue groups had met twice, while a third group had met three times. The teacher had been present at the meetings of the third group, which was her lunch period. With the schedule change in the lunch periods all of the groups were disrupted as the students in each group no longer had the same lunch period. There was chaos in the school for over a week, as students and the teachers tried to figure out whether the schedule changes were temporary or would last the whole semester. After it seemed that the schedule change would be kept in place, one cogenerative dialogue group was reconfigured with two student members from different prior groups, a new student member, and the teacher. This latter group met three times during the final months of the semester. Table 1 shows who the participants were in each group and how many times the groups met.
Table 1
Participants and Group Meetings

<table>
<thead>
<tr>
<th>First Half of Semester</th>
<th>Group Members</th>
<th>Number of Dialogues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>C.P., Payton, researcher</td>
<td>2</td>
</tr>
<tr>
<td>Group 2</td>
<td>Kat, Michael, Barrett, researcher</td>
<td>2</td>
</tr>
<tr>
<td>Group 3</td>
<td>Mariah, Greg, Juan, teacher, researcher</td>
<td>3</td>
</tr>
<tr>
<td>Second Half of Semester</td>
<td>Group 4</td>
<td>C.P., Greg, Simon, teacher, researcher</td>
</tr>
</tbody>
</table>

Undoubtedly, the disruption of the cogenerative dialogue groups hampered the overall effectiveness of the cogenerative dialogues in reaching their “catalytic” potential (term from Guba and Lincoln’s (1989) authenticity criteria) for the development of student agency and improvement of the teaching and learning in the classroom. In order to find out what the experience of the cogenerative dialogues was like for the teacher and the students, they were each asked about this during the second and third interviews. They were also asked if they perceived that the dialogues had influenced the class curriculum, peer-peer relationships, or student-teacher relationships. Several of these comments are shared in the section below.

The Teacher’s Thoughts on Cogenerative Dialogue. During the second interview with the teacher (part 1, 4/29/09), Mrs. P was asked her opinion of the cogenerative dialogues thus far. She had attended three dialogues prior to this interview, and she and the researcher had the following exchange:

P: Um, I think they’re okay. I don’t think that we have enough time to do very much in them.
E: Yeah, they’re too short.
P: They’re too short, and we, you know, we spend-, I don’t know, I guess I’m not clear on what your goal is for them. I don’t know what you’re trying to do with them...And so, you know, it’s nice for me to have the opportunity to talk to a
couple of kids, you know, it helps me connect with them better, so from my personal perspective that’s good.
E: Right.
P: But that’s not what you’re trying to do, I don’t think. I don’t know what you’re trying to do, so-

From this vignette it is evident that Mrs. P is unclear about the purpose of the cogenerative dialogues. This semester was her first experience with these dialogues, and due to their short length, she is having a difficult time seeing what they are supposed to accomplish. Following this vignette, the researcher reminds Mrs. P of the two main purposes of the dialogues as described above in the introduction to this section.

By her third interview (part 1, 6/25/09), after the teacher had participated in six dialogues, she maintains that the dialogues are too short, but now expresses an understanding of the potential benefits of the dialogues. After being asked about her overall impression of the cogenerative dialogues, Mrs. P replies:

P: They weren’t long enough...I think that they are a very powerful tool in engaging with kids. Um, I don’t know how I’m going to find the time to do it when I next get to teach Environmental Science again, but I think that it is really important that I do it.
E: Yeah, yeah.
P: Um, I think that they are successful to the degree that I can be as open-minded and as blank a slate as you were because they felt they could say anything to you, and I don’t think-, I’m so out there with how I feel about things, you know, that I don’t know whether I could carry it off the way you did. I mean you really obviously were able to disguise how-, what your feelings were because they didn’t know how strong an environmentalist you are.
E: Yeah, which is amazing to me.
P: Yeah, but that just shows, I mean, you did a great job.
E: Yeah, yeah.
P: So, um, I want to try to do them, and I think that, um, I don’t know how important it’s going to be that I buy them lunch.
E: Right, right, that was a pretty big incentive at first...
P: It was a huge incentive.
E: ...that’s for sure, to get them coming at the beginning, yeah, yeah.
P: Um, so, you know, I thought they were powerful, but too short.
In this vignette, Mrs. P mentions some important logistical concerns with the dialogues, the first of which was establishing a time for the meetings when both the students and the teacher could meet. Secondly, getting students to come to the meetings was originally achieved through compensating them with lunch, which was paid for with research funds - a source which the teacher will not have available. Third, Mrs. P maintains that the dialogue meetings were too short, although she saw their potential and hoped to be able to initiate them with future classes.

**Student's Thoughts on Cogenerative Dialogue.** The following vignettes from the students’ second and third interviews reflect both the students’ experiences participating in the cogenerative dialogues and the influence, albeit limited, that the cogenerative dialogue had upon the class and social interactions amongst members of the group. The selections below demonstrate ways in which cogenerative dialogue can promote student agency, peer-peer relationships, and teacher-student relationships, but also ways in which the dialogues were limited in what was achieved.

**The Experience of Cogenerative Dialogue**

One of the ways in which cogenerative dialogue affected the students positively was by giving them a place to have their voice heard. One student, Mariah, expresses how she valued this opportunity in the following vignette from her second interview (4/30/09). Here she references a dialogue where she asked the group their ideas about abandoned animals, which was a subject of great concern to her:

E: Oh, okay, so what do you think of the cogenerative dialogues that we were doing?
M: Oh, those are fun, actually. I can actually, like, I don’t talk a lot at lunch usually because everybody else is talking and I feel like I’m interrupting.
E: Oh, okay.
M: So, you know, it feels like I’m actually wanted there.
E: Oh, okay, well that’s nice.
M: Yeah, and it’s fun to just like share opinions on stuff, like the whole abandoned animals thing that we did the last time I was there was fun, so-
E: Yeah, yeah.
M: Abandoned animals still make me sad.
E: Yeah, that’s something that you really care about.
M: Yeah.
E: That was great that you shared that.

For other students, the cogenerative dialogue provided an opportunity to discuss issues in class with others and hear how others were thinking about these issues. For example,

Greg states during his second interview (4/15/09):

The group one [dialogue] was fun cause you could ask questions, you see Ms. P’s opinion, everyone else’s opinion, and, you know, everyone’s opinion might not be the same, but, you know, no one thinks the same, so you get to see, oh, that’s really what you think about that, that’s interesting because I think this about that, and they kind of relate to each other.

Greg also seemed to realize that the dialogues were an opportunity to give the teacher feedback on how the class was going. During his third interview (6/3/09), he states:

I mean, it’s like a constant update. It’s like, it’s not just how’d you feel, “What do you like about this class?” at the beginning of the class and then one big summary at the end. It’s like, you can, it’s different steps where [it can be] changed, like “Oh, I like how this is going. I don’t like how that’s going.” “Okay, well, we’ll change it. We’ll tweak it a little bit,” or “I like how this is going, not how that’s going.” “Oh, you changed this, and it’s a lot better. I like it this way.” It’s just-, positive and negative feedback is always good, you know. It’s always good to have, you know, a type of feedback.

While Greg seems to realize the purpose of having the teacher present for the dialogues, there was differing opinions among the students about how open the cogenerative environment was for sharing ideas when the teacher was present. In Mariah’s case, she felt that she could openly share her ideas with the teacher present. However, another student, C.P., says that he felt the dialogues may have been more meaningful for him if
the teacher was not present. During his third interview (6/4/09) when asked about his
experience with the cogenerative dialogues, he replied:

C: They’ve been really cool. It’s been nice to hear what other students in the class
have to say, and hear what they’re getting out of it and their interpretation. I think
it might have been better in like the ones with me, Greg, and Simon, if Mrs. P
hadn’t been there because we might have talked more candidly.
E: Hm, m-hm.
C: No, you know what I mean?
E: Yeah, totally.
C: Cause with Mrs. P there we....
E: I was going to ask you about that actually.
C: ...in a way had to, we kind of had to watch what we said.
E: Right, but at the same time if she’s not there then she doesn’t know what
you’re saying either, yeah, so that way she can actually get feedback from you
about how things are going in the class and that kind of thing.
C: Yeah.
E: But you thought like you sort of had to watch what you were saying when she
was there.
C: Well in some ways.
E: A little bit.
C: Yeah.
E: Okay, that’s good feedback.

Another student, Kat, who was present at one of the cogenerative dialogues without the
teacher says that she appreciated having an informal setting to discuss issues being
presented in class without having to worry about the teacher’s presence. During her third
interview (6/8/09), she had the following exchange with the researcher:

E: Okay, so you liked sort of being able to discuss things that you were doing in
class, but sort of in an outside of class like informal setting.
K: Yeah, cause like if we wanted to talk about Ms. P, we didn’t have her popping
up.
E: Right, right, yeah.
K: Cause I’ve never said anything bad about her, or at least I don’t think I have,
but I don’t know, it’d be awkward if I said something and all the sudden she was
there. I’d be like, yeah, please don’t deduct points from me.

These vignettes point to the tension between the two purposes of the cogenerative
dialogue in this research project. With the teacher present, there is an opportunity for her
to hear the students' thoughts regarding what is working and not working for them in class. However, as stated by C.P. above, he did not feel he could be totally open about his feelings with the teacher present. On the other hand, if the teacher is not present, students may feel more comfortable expressing themselves providing more accurate information for the research, but it is very hard for this to be followed up with change in the classroom if the teacher is not present to hear their comments. It is possible that if the cogenerative dialogues had been held regularly over the course of the semester, the group may have developed a higher level of comfort with the teacher present. However, the lack of continuity limited this comfort level from getting established.

The Influence of Cogenerative Dialogue

As mentioned above, none of the students met with the same group for more than three meetings, although one student, C.P., did participate in five meetings and another, Greg, six meetings during the semester. The following quotes are from the two students, C.P. and Greg, during their third interviews where they are discussing their perceptions of the cogenerative dialogues. When they were asked whether they saw a direct correlation between things discussed in the dialogues and what was happening in class, Greg replies that he does see a connection:

G: Yeah, cause when we were over there in Ms. D’s room, when we were talking all about the-, “I’m thinking about doing this thing” and then we were like, “Yeah, that’s a really good idea. We should definitely have a town meeting, and kind of debate it,” and she’s like, “Alright, we’ll do it,” and then, right there, we did it the next day, you know, it was pretty cool.
E: Yeah, yeah.
G: You know, who knows if she’ll have like-, cause we were talking about like an out of school field trip type thing - we meet in this one spot and we drive to this old growth forest. I mean, you know, if she does that in her future [classes], it was because of us, we said, “Hey, that’s a really good idea. I would, yeah, I would go” and she, you know, maybe she’ll, who knows, if she’ll do that next year, you never know. (Interview 3, 6/3/09)
From the latter half of the quote, it is also clear that Greg feels that Mrs. P values his opinion, even if she cannot act on it immediately. In contrast, C.P. is unable to come up with any connection between the dialogues and their impact on the class. When asked if he noticed any influence from the dialogues on class, he replies:

C: Not that I can really think of.
E: No?
C: No, not that I can really think of.
E: Okay.
C: I mean it’s quite possible, quite probable that there was, but not that I can think of off the top of my head. (Interview 3, 6/4/09)

Although C.P. does not see an impact from the cogenerative dialogues on the class, he is the only student to mention that the dialogues played a role in changing his behavior. In the following vignette from C.P.’s third interview (6/4/09), the researcher is asking C.P. a follow-up question after he says that he has cut out meat from all his lunch meals as a result of experiences in class:

E: Okay, I want to ask you more about changing your eating, cause I’m really curious because when we had our last cogenerative dialogue, do you remember I was asking you guys like if you felt like you were addicted to meat?
C: Yeah, I remember that.
E: And you guys were talking about how maybe culturally, cause it’s so kind of engrained in you and you’ve just being eating your whole life, and you were sort of adamant about that, and that was only like three weeks ago.
C: Well, yeah, I mean…
E: Yeah, so I’m wondering what’s sort of triggered you to be like, “Oh, well maybe I can eat less meat.”
C: Well, some of the stuff that Simon, especially, and Mrs. P brought up, and initially it really started when I ran out of lunch meat and was just like, “Hey, I’ll make peanut butter and jelly” and I just got used to it for the next couple of weeks, and I was like, “Hey, this isn’t hard like at all.”
E: Right, right, yeah, okay, so you just kind of tried it almost as an experiment or something, an accidental experiment.
C: Yeah, and it’s been working out. Meanwhile, I’m not like-, you know, I’m not sure right now if I’ll ever go, you know, full on vegetarian, but it’s a thing I could see myself doing, like a very lax vegetarian, kind of like Mrs. P.
This is the only clear example of a student stating that he was directly impacted by the conversation that took place during the cogenerative dialogue. In this case, Simon had been discussing his recent change in becoming a vegetarian, and this had a direct influence on C.P., who decided to try out not eating meat as a result of this dialogue in combination with other experiences in class.

In terms of their relationship with the teacher, both Greg and C.P. said that the cogenerative dialogues improved their rapport with the teacher in some manner. When Greg is asked if the dialogues increased his comfort level with Mrs. P, he replies:

Yeah, a little bit, just cause it was more one-, not one-on-one, but, you know, small group kind of talking, you know, casual eating lunch and just talking, kind of, just getting-, more or less knowing each other, kind of: “Well, this is how I feel. That’s how you feel, and now I more or less know how you feel about that,” so you feel like you’re closer. (Interview 3, 6/3/09)

While Greg had a positive relationship with Mrs. P throughout the course, C.P.’s relationship with the teacher was more strained at times as he routinely questioned Mrs. P during Socratic dialogue sessions. When asked how the cogenerative dialogues affected his relationship with Mrs. P, C.P. responds:

C: I think I kind of eased up on her in a ways and like my whole devil’s advocate kind of thing that I had going on. I kind of like-
E: You mean as a result of the dialogues?
C: Yeah, I guess.
E: Yeah, okay, was that a conscious thing, or it was just sort of getting to know her better?
C: Yeah, I think...it might have been both. It was both, I would say...both conscious and getting to know her better, you know, getting to know her, and then, and like thinking about saying it and just being like, “Oh, whatever.” It doesn’t really matter that much.
E: Yeah, so kind of becoming more aware of your own-, yeah, so it’s kind of becoming more self-conscious too about what you’re saying and stuff. (Interview 3, 6/4/09)
Here we see that the dialogues may have had some positive effect easing the tensions that existed between Mrs. P and C.P. While these students met with the teacher in the dialogue groups five or six times, the most any student met with their peers in a group was three sessions, which may have limited the impact upon peer-peer relationships.

When Greg was asked whether the dialogues changed his relationship with any of the other students, he replies:

Not really, I mean, me and Juan, we’re in the same class, so nothing changed with us, we were all set, and Mariah, I mean, I know her a little bit, you know, if I see her in the hall or something, I’ll say hi or something, and C.P. and Simon, they’re always there, you know, they see me, say hi and stuff, but as far as it goes from there, nothing really. I was-you know, I sat next to Simon today, I was like, “Hey, whenever you want to put in input, go for it,” and he’s like, “I am. I’m thinking of stuff right now,” so I was, “Alright, that’s good,” so- (Interview 3, 6/3/09)

C.P. comments that the dialogues helped him get to know the other students better, and this did have an influence on how he viewed them in class. In his third interview (6/4/09), C.P. states:

C: Yeah, cause Greg especially, cause he’s-, in a lot of ways, he’s a lot smarter than I think some people give him credit for, cause he’s a really smart kid, so I kind of like listened to him more and respected his opinion a little bit more.
E: Mm, yeah.
C: And Simon’s really smart too, but in a different way. Like Simon is a lot more philosophical, and Greg is more like common sense, kind of down to Earth, get to the point.
E: Yeah, that’s a really good characterization of the two of them.

From the student comments, one can only hypothesize that if the dialogues had been held more regularly with the same group of participants, then there likely would have been more of an impact upon their relationships, the classroom culture, and/or their ideas relating to the issues being discussed. However, due to the limited number of sessions with any one group of participants, it was difficult for the dialogues to play their intended
role in improving the teaching and learning in the classroom, as there was insufficient
time to generate clear goals that could be enacted in the classroom and then reflected
upon during later dialogues.

**The Researcher’s Thoughts on Cogenerative Dialogue**

From the researcher’s perspective, the cogenerative dialogues were an invaluable
source of data and relationship building between the researcher and the participants. In
addition to the student interviews, this was another opportunity for the researcher and the
students to get to know one another outside of the classroom setting. In addition to
building social connections, the dialogues provided data on students’ feelings and
reactions to events in the classroom in a more immediate manner than was possible with
the interviews. For example, vignettes from the dialogues related to whether students
were connecting with the topics of old growth forest and tropical rainforest being
discussed in class are presented in the results chapters.

Only a few sections from the dialogues were reported in the results chapters
because although the dialogues often confirmed the statements that students made during
their interviews, the dialogues involved multiple people talking and are therefore often
harder to follow in written form. Therefore, in many cases where the content was very
similar between the interview and cogenerative dialogue data, the vignette from the
interview was presented. This validation between the two sources served as a helpful
means of triangulating data and ensuring accurate interpretation.

As noted above, the lack of continuity over the semester of the cogenerative
dialogues limited the impact of the dialogues on both development of peer-peer and
student-teacher relationships and resulting change in classroom structures. Therefore, in
future studies in order for cogenerative dialogues to reach their full potential in developing student agency and improving the teaching and learning in the classroom, it is imperative to establish a meeting time that is longer than 30 minutes (even 45 minutes would be better) and a regular meeting schedule.

Lack of Generalizability

Secondly, in qualitative research of this nature, it is unfeasible to visit a large number of schools and classrooms, thereby potentially limiting the generalizability of the results. Also, due to the tremendous amount of time and effort necessary to accurately transcribe, code, analyze, and interpret audio and videotape, the researcher is limited to a small sample size upon which to focus. The richness of the descriptive data is the primary goal, and as such, the logistics dictate that the sample size remains necessarily “small.” It is important to reiterate here that the intention of this research was not to test any specific hypotheses, but rather to explore new potential directions for environmental education research, in addition to identifying factors that seem to be playing an important role in affecting students’ environmental identity and associated behaviors during the Environmental Science course. Future studies are needed to confirm and extend the findings of this study to a larger population of students.

The Subjectivity of Research

Additionally, ethnography involves a researcher trying to make meaning and translate another’s world, but this is always an imperfect process. Agar (2006a) describes an ethnographer’s work as “the translation between LC1 and LC2” where LC1 refers to the languaculture of the researcher and her audience, and LC2 refers to the languaculture of the studied group (p. 10). Languaculture is a term used by Agar which is used to
E: Yeah, okay, and how do you think it influenced you personally? Like in terms how you’ve done in the class or how you’ve learned?
A: Um, good. You’re there to help me, you’ve asked if I needed help. If I needed help, I could ask you.
E: Right, so just knowing that another person was there as a resource.
A: Yeah.
E: Okay, do you think it made you take the class more seriously?
A: Yeah, I would say, yeah, or else I probably would have goofed off more, if I didn’t know that I was being videotaped.

This is the only mention of the videotape in any of the student responses about the impact of the researcher in the classroom. These comments from Allen show that he felt the video camera kept him from “goofing off” more because he knew he was being filmed occasionally.

The final response presented here is from Rick during his third interview (6/8/09) who saw little effect in having the researcher in the classroom. In response to being asked how he thought the researcher influenced the class, he replied:

R: I don’t know. I guess it made it easier, I guess. For questions, there was another person there to ask.
E: Yeah, anything else that you noticed that may be different from other classes cause there wasn’t a researcher there?
R: Um, not really.
E: You didn’t notice too much it affecting class.
R: No, sorry.
E: Okay, no, that’s fine. Um, so you didn’t feel like it affected you personally too much during class?
R: Well, I mean these interviews, the interviews that I’ve done.
E: Yeah, what did you think about that?
R: They’re nice and, um, good to be getting interviewed, I guess.
E: Yeah, so do you sort of appreciate being asked your opinion about things.
R: Yeah.
E: Well, I appreciate you giving me your opinion.

This student, similar to Kat’s response above, also perceived that the researcher had little influence upon the class, with the exception of having another person there to ask and
answer questions. Rick also comments that the interview process has been a positive one for him, as he appreciates having attention given to his opinion.

Overall, there was a wide range of perceptions among the student interviewees regarding the role of the researcher in the class. Some students, such as Mariah and Greg, seemed to focus in on the researcher’s few appearances in the “front of the class” or the researcher’s limited interactions with the teacher during class. The other students saw the researcher as more of a resource who was there to provide support in answering questions or helping with explanations or research. There was also a mixed response regarding whether the presence of the researcher caused students to take the class more seriously. Greg and Allen both said that it did cause them to take the class more seriously, whereas C.P. and Kat said they would have taken the class seriously anyway. The responses of the other students were less clear. Fortunately, all of the impacts noted by the students were either neutral or in the beneficial direction for them. It is not clear, of course, how open or honest the students were being given that they were speaking with the researcher in answering these questions. This needs to be taken into account when interpreting their comments.

The Researcher’s Thoughts on the Role of the Researcher

In a discussion with the teacher during her second interview (part 2, 5/14/09), the teacher asked me, the researcher, whether it was my intention to limit my influence on the class. I had the following exchange with the teacher:

E: Well, I kind of new from the beginning that I would [influence the class], so I didn’t really go in with that expectation. I mean I tried to sort of not say a lot during the first like six weeks, so-
P: M-hm, you still don’t say a lot.
E: No, not during class, but after class, I talk to you a lot now.
P: Well, yeah.
E: But the first six weeks, I didn’t really-, every time you asked me how things were going or whatever, I always just said, “Oh, they’re great. They’re great” at the beginning because I didn’t want to-, I mean I was just sort of taking it all in at the beginning anyway, but I'm not really like a good sit on the side kind of person, so I always knew that I wouldn’t be able to do that, like...
P: ...forever.
E: ...infinitely.

After the first six weeks of the semester, I began to have more lengthy discussions with Mrs. P after class regarding her interactions with students in the class and providing suggestions from my own prior teaching experiences for activities that might work with this group of students. Mrs. P stated that she was always looking for interactive activities that would engage the students in a different manner from the Socratic dialogue, which was her most comfortable teaching strategy. In this way, I felt I began to take a more active role outside of class in influencing the types of activities that the teacher enacted. Specifically, the class period spent outdoors obtaining tree core samples, as well as the mock town meeting (discussed more fully in Chapter 4), were both activities initiated by the researcher.

Within class, I felt that the description presented by Kat above in the student statements most accurately stated how I perceived my own role in the classroom. I was primarily an observer, as I spent the large majority of each class period sitting in the back row of the class typing field notes. I was unaware of the impact my facial expressions had on the teacher indicating whether I was understanding her points or not. My field notes indicate that approximately once or twice a week I would make a comment during the class discussions often adding an idea or opinion. I walked around the room when students had an individual writing assignment to see if they needed assistance. Additionally, I led one of the groups in preparing for the Alaska National Wildlife
Refuge Debate, and helped students find library resources for their roles in the town meeting and for their endangered species project. Finally, as noted above, I gave a power point presentation at the request of the teacher on my trips to Costa Rica and Panama about current environmental issues in those countries, and I served as a moderator during the town meeting and score keeper during the ANWR debate.

On another note, I feel that my presence in the classroom and the students’ and the teacher’s sense that they were part of a larger research project contributed to a higher level of attentiveness in the class, although there were still several students who talked, slept, “goofed off,” etc. during class even with the researcher present and the video camera recording. Mrs. P commented on various occasions that students in this lower level Environmental Science course were taking the class more seriously than students in other years. I must attribute at least part of this to the involvement of the class in this research project.

Finally, I was very conscious of taking as little class time as possible for research purposes. Therefore, the signing of consent forms, signing-up volunteers for the interviews and cogenerative dialogues, setting up the video camera, and scheduling of interviews and cogenerative dialogues were done at the beginning or end of class, as to limit any interruption of class. Additionally, all interviews and cogenerative dialogues were done outside of class time in order to minimize loss of class time for the students involved in the research. It is my hope that the benefits to the students and the teacher of having another resource available to them far outweighed any small negative effect from distractions due to the research going on in the classroom. From their comments above, I have to believe that was the case.
Ethical Issues

This research design, as does all research, contains ethical issues that I would like to briefly outline here, but which are more thoroughly discussed in my proposal to the Internal Review Board at the University of New Hampshire. In any research involving participant observation, the researcher is in danger of being viewed as an “outsider” who has come to “study” the group under observation. In an attempt to limit this interpretation of my role in the classroom and develop reciprocal relationships with the participants in the study, I decided to be a participant in the classroom on a daily basis from the first week of the semester through the last. From day one, I sat in the back of the room at one of the two-person tables with a student, who ended up being the “student researcher” discussed above. On most days, I sat at my laptop computer taking field notes of the events as they occurred in the classroom. I participated in classroom activities by helping students individually or during group work, only as requested by the teacher. I also did a power point presentation of my trips to Costa Rica and Panama about environmental issues in the tropical rainforest at the request of the teacher. Additionally, I acted as a moderator during the town meeting and a score keeper during the class’s debate on the Alaska National Wildlife Refuge. Since my own background is in Environmental Science, and I am certified to teach high school Biology and Earth Science, I felt strongly that I should give back to the classroom during this project when appropriate.

Throughout the semester, I tried to keep a non-judgmental stance of the teaching strategies being used in the classroom. After the first month of the semester, the teacher would occasionally ask for ideas to make her lessons more interactive or hands-on for the
students. In these cases, I discussed possible activities with the teacher from my own teaching experiences. Some of these she implemented in the classroom, most notably the mock town meeting, which I helped her organize. I also brought in tree-coring equipment from the University of New Hampshire’s Natural Resources Department in order to demonstrate for students how to collect a tree core and count the rings of the tree. I was careful, however, not to push my curricular ideas in my discussions with the teacher, but rather to provide suggestions at her request.

Students and the teacher were aware of my research agenda from the first day of class when they were asked to sign consent forms, and had the opportunity to ask whatever questions they had about my research at any point during the process. On occasion students would ask during class what I was typing on my computer, and I always showed them since it was basically a chronology of events taking place in the classroom. Additionally, I gave students the opportunity to ask questions about my research at the end of each of their interviews and several of them asked why I was doing the study and what I was going to do with the results. Each time, I reviewed the aims of the study and my plans for writing my dissertation and publishing the results.

It was made clear that participation was voluntary, and that they could decide to end participation at any point. Participants were informed that all data would be reported anonymously through the use of pseudonyms, and confidentiality would be of utmost importance. Students also had the opportunity to choose their pseudonym if they wanted to, and several of those pseudonyms are used in the results chapters of this dissertation.

Finally, it was a privilege to become part of this classroom, and therefore I felt the responsibility to respect the needs and agenda of the members of the classroom, and put
their needs in front of mine when necessary. I continually did my best to be flexible and supportive so that cooperative relationships were established during the research process.

I wanted the experience to be beneficial not only for my research purposes, but perhaps more importantly, for the teacher and students involved as well.
CHAPTER 3

THE PROCESS OF CHANGE IN STUDENTS' ENVIRONMENTAL IDENTITY AND PRO-ENVIRONMENTAL BEHAVIORS DURING AN ENVIRONMENTAL SCIENCE COURSE

Environmental Science elective courses are growing in popularity in our public high schools (Edelson, 2007), but little research has been conducted to evaluate these courses' effectiveness in educating students about the environment and humanity's role in shaping our environment (Zelezny, 1999). This ethnographic study at a public high school in the Northeastern United States investigates the process of change in students' understanding of their relation to the environment and pro-environmental behavior during an Environmental Science course. Specifically, the study uses a sociocultural approach to explore how factors such as students' background, social interactions, and classroom structures impact the environmental learning of students. In this evaluation, both rational and non-rational factors influencing students' reactions to classroom experiences are explored in order to gain an in-depth understanding of obstacles and affordances to the process of change. The participants in this study are an Environmental Science teacher and the 10-12th grade students in her Environmental Science elective course. The researcher collected data for a period of six months during the spring semester of 2009, attending class on a daily basis. Data was collected through participant observation, videotaping, interviews, cogenerative dialogues, and an environmental attitude and behavior survey. The results of this study provide new information for educators working
with students to help them define their relationship with the environment by illuminating the elements contributing to whether a student is likely to change his/her views towards the environment and pro-environmental behaviors. Additionally, results highlight the classroom structures that affect the environmental learning of students over the course of a semester.

**Introduction**

In recent years, there has been an increase in the number of secondary schools teaching environmental science, as a part of the core curriculum, an elective, or at the AP level. Specifically, in 2000, 39% of high schools offered an Environmental Science course, which was an increase from 24% in 1993 (Edelson, 2007). Edelson (2007) states that teachers “frequently report that they are able to successfully engage students in environmental science classes that have not engaged or been successful in prior high school science courses” (p. 42). Despite this anecdotal evidence that these courses are successfully engaging an often hard-to-reach population of high school students, few studies have been done to determine which aspects of these classes are helping students to learn science effectively, while bringing about a heightened environmental awareness (Zelezny, 1999).

This study is an in-depth exploration of how students’ environmental identity and associated pro-environmental behaviors change as a result of an Environmental Science course, aimed at highlighting classroom structures and activities as significant leverage points in bringing about this change. Environmental identity is a construct referring to an individual’s connection to the natural environment based on experiences and attachments that affects who we are and how we interact with the world (Clayton, 2003). This aspect
of one's identity has been found to be linked to one's conservation-related behaviors (Burke, 1980; Clayton, 2003; Kals & Ittner, 2003; Kempton & Holland, 2003), and therefore is a key structure to investigate in the attempt to expand our understanding of the students' experience in the Environmental Science classroom.

Rather than focusing on environmental identity, most of the research that has evaluated both formal and informal environmental education programs has used quantitative survey instruments to measure change in students' environmental knowledge, attitudes, behaviors (Culen & Volk, 2000; Dunlap et al., 2000; Hsu, 2004; Kuhlemeier, Bergh, & Lagerweij, 1999; Manoli & Johnson, 2007; Meinhold & Malkus, 2005). The purpose of these particular studies is to report on a program's effectiveness, rather than determine what the key elements are that are bringing about change or documenting what the process of change looks like for individual students. As we begin to explore the factors affecting change, this study uses a sociocultural focus combined with an ethnographic approach in order to broaden the scope of research to better understand how experiences in the classroom are affording or hindering change in students' environmental identity and associated behaviors from occurring.

Sociocultural theory posits that learning is embedded in social activities that occur as a child interacts with people, objects, and events in her environment, and suggests that it is necessary to examine the external social world of an individual in order to understand her development (Kublin, Wetherby, Crais, & Prizant, 1989). In utilizing a sociocultural framework for this study, learning is viewed as a social process, just as environmental problems are viewed as existing within a social and cultural context. As noted by Clayton (2003), "An understanding of oneself in a natural environment cannot
be fully separated from the social meanings given to nature and environmental issues, which will vary according to culture, world view, and religion” (p. 53). Therefore, this study considers interaction between various social actors as important in the process of change in one’s environmental identity. In addition, both students’ emotional responses and willingness to critically reflect upon these interactions are explored in depth with students to determine how they are responding to their experiences in the classroom. These elements are investigated because both emotion and critical reflection have been documented as important in the process of environmental identity development (Horwitz, 1996; Kals, Schumacher, & Montada, 1999; Kovan & Dirkx, 2003).

As we consider the context of the Environmental Science course and investigate the process of change experienced by the students in the class, we must take into account, as has been suggested by Holmes (2003), that “Not only the people of whom we ask the questions, but the questions themselves must take into account the social location as both shaping and being shaped by environmental experience and identity (p. 37). In particular, the research questions explored in this study include (which are adapted from topical questions #1,3,4 presented in Chapter 2):

1. How do students’ environmental identity and associated pro-environmental behavior change as a result of taking an environmental science class? What are the leverage points (activities, experiences, etc.) for change?

2. How do the sociocultural structures of the classroom mediate the (potential for) change in students’ understanding of their relationship with the environment and their behavior?

**Literature Review**

As noted above, several studies have been conducted previously evaluating the effect of various environmental education programs on students’ environmental
knowledge, attitudes, and behavior, only two of which were conducted at the secondary level (Kuhlemeier et al., 1999; Meinhold & Malkus, 2005). Both of these studies use quantitative survey instruments to measure these constructs, and determine if a relationship exists between them. The findings from both studies indicate that environmental knowledge has a low correlation with environmental attitudes and behavior among secondary students, suggesting that teaching environmental content is likely insufficient to bring about change in the other constructs. However, while Meinhold and Malkus (2005) study a population of adolescents from high-achieving high schools in three large US cities and Kuhlemeier et al. (1999) target high school students in the Netherlands, neither attempts to make any correlation with the particular curriculum or coursework to which these students had been exposed. Additionally, the studies do not look at change in the constructs over time, but rather provide an estimation of the status of students' environmental knowledge, attitudes, and behavior at a given point in time. These studies suggest that further work needs to be done to determine what other elements besides knowledge are significant predictors of students' environmental attitudes and behaviors, and how these relationships may change over time.

In contrast to the above two studies, the following studies investigated change in environmental attitudes and behaviors over time as students participated in a specific environmental course (Culen & Volk, 2000; Hsu, 2004). They both analyze a teaching approach called the “Issue investigation-evaluation and action skills training model” by giving pre- and post-tests to experimental and control groups of students. Taught during a 10-14 week period, this model is a case-based approach to the teaching of environmental science and incorporates the four major goals of science foundations, issue awareness,
issue investigation and evaluation, and citizenship action. Culen & Volk (2000) studied how this teaching model is implemented with 7th and 8th graders, while Hsu (2004) evaluates the model as it is applied in a university level Environmental Science course in Taiwan. While findings show positive increases in responsible environmental behavior, environmental attitudes, and intention to act, the classroom level quantitative data provides little information regarding what factors accounted for the variance in the study outcomes for individual students. In this research, therefore, special focus is placed on the individual students within the sociocultural context of the classroom in order to further explore how differences in the students’ experiences, backgrounds, and social interactions affect the process of change over time during their participation in the Environmental Science course.

In addition to the constructs related to environmental attitudes and behaviors, several recent studies have been done relating the significance of the self or identity to human relationships with the environment. However, these studies have focused on significant life experiences of adult environmental activists or professionals rather than the general population at large or adolescents (Chawla, 1998; Chawla, 1999; Kempton & Holland, 2003; Zavestoski, 2003). For example, Zavestoski (2003) conducted a qualitative study with participants at a Deep Ecology retreat. Through participant observation, interviews, and identity surveys, he learns of the difficulties many of these committed environmental activists encounter in maintaining their environmental identities in a social world filled with “social actors” with less developed environmental identities. The findings show that many of the activists sought ways of nurturing and sustaining their environmental identities through their career choices, spiritual
affiliations, and social networks (Zavestoski, 2003). Similarly, Kempton and Holland (2003) conducted 159 “identity interviews” with members of representative types of environmental organizations, where they investigated each participant’s history of involvement with the environmental movement, providing useful information regarding the process of environmental identity development, which is explicated in the Environmental Identity section below. However, Holmes (2003) makes the suggestion that we must expand this range of research participants to incorporate a wider range of socioeconomic and cultural diversity, rather than focusing specifically on environmentalist participants, in order to determine both the factors that are challenging as well as affording development of individuals’ environmental identity. By focusing on adolescents in a public high school that come from a variety of environmental backgrounds, the current study has been designed to begin to address this void in the current research.

Theoretical Framework

In utilizing a sociocultural approach to explore the process of change in students’ environmental identity and associated behaviors, each individual’s relationship with the environment is seen as inseparable from her social world and interactions. As we consider the student’s identity within the classroom culture, the field of sociology informs us that aspects of one’s identity are often intricately linked with emotional responses and resulting behavior (Burke, 1980). Therefore, it becomes imperative to understand the work that has been done in this field linking the concepts of emotion and identity before we proceed to extend these concepts to the notion of environmental identity in the following section.
Theorizing on Emotions

Since the 1970’s, the field of sociology turned to questions of the role of emotion in regulating self-processes, and how emotional attachments shape interactions between people acting within social structures (Turner & Stets, 2005). Of the multiple theoretical approaches that have emerged in this field, the *symbolic interactionist* theories emphasize identity as a prominent regulator of emotion and resulting behavior. This group of theories has grown out of the conceptual synthesis of George Herbert Mead and Charles Horton Cooley in the first half of the 20th century, describing how social interactions allow each individual to predict and react to the behaviors of others as individuals attempt to maintain esteem in a social situation (Turner & Stets, 2005). According to these theories, emotional dynamics ultimately revolve around the processes of confirmation or disconfirmation of situational identities in a social context. Due to the emphasis here on social influence, often guided by cultural norms, these sociological theories are in line with a sociocultural perspective of learning, which posits that learning occurs predominantly through social interaction and cultural influence. The *symbolic interactionist* theories extend the influence of social interaction to one’s identity, suggesting that it is difficult to separate one’s identity from the social and cultural context in which it is formed. These theories therefore become useful in interpreting the emotions that individuals experience as their self-conception is affirmed or disconfirmed during the course of interaction (Turner & Stets, 2005).

If we conceptualize environmental problems as problems of social organization (Bell, 1998), and environmental identity as seen as existing within a social framework, then Zavestoski (2003) argues that symbolic interactionist theories of identity are central
to understanding how identities result in specific roles and behaviors in society. Because this study examines the environmental identities of the participants within a social context, symbolic interactionist theories, specifically those of Stryker (2004) and McCall and Simmons (1978), are utilized in analyzing the emotional responses evident in the students’ reactions to events experienced during the course of the study.

Sheldon Stryker (1980, 2000, 2004) has built a theory of emotions centered around identity processes, placing the self within local social networks. In Stryker’s view, an individual may assume multiple roles within these networks resulting in diverse identities emerging in different settings (Turner & Stets, 2005). Accordingly, Stryker conceptualizes these multiple identities as organized into a “salience hierarchy” with those identities high in the hierarchy more likely to be enacted and situations where a more salient identity can be enacted, more likely to be sought out. For example, a nature enthusiast with this identity high in her salience hierarchy will likely seek out situations where this identity will be valued, thus reinforcing the prominence of this identity.

Stryker (2004) describes three ways to conceptualize the role of emotions in the identity process. The first of these considers an individual’s emotional response to others’ reactions to one’s “role performance” of a given identity. When others affirm one’s identity, positive emotions will be experienced, tending to raise the salience of that particular identity. The higher the identity is ranked for an individual, the more acute will be their emotional response. In contrast, when one’s identity is disconfirmed, negative emotions will be experienced, forcing the individual to reevaluate commitments to an identity.
The second conceptualization described by Stryker (2004) involves judging one’s identity as adequately meeting cultural expectations and frameworks of a specific social network. If a person feels that her “role performance” is meeting cultural standards, then that identity will be affirmed along with enhanced self-esteem. If a person does not believe they are meeting expectations, then they will experience negative emotions, particularly shame or guilt. Finally, the third way to conceptualize identity and emotion is that as a means of social control a person will tend to develop an identity that is affirmed, while lowering an identity in the salience hierarchy that is not meeting the normative expectations of a social network.

McCall and Simmons (1978) developed a similar identity theory to that of Stryker with the important addition of possible results when a person perceives a discrepancy between their own identity and situational or cultural expectations, resulting in negative emotions. As an individual attempts to placate these negative emotions, the possibilities include (1) “short-term credit” where a particular episode of nonsupport for an identity is essentially ignored as a one-time event; (2) “selective perception” so that elements of a situation are given selective attention thereby affirming one’s identity; (3) “selective interpretation” in which elements are accurately perceived, but interpreted allowing for identity affirmation; (4) withdraw from the interaction or situation that is disconfirming the identity; (5) switch to a new identity that is more easily confirmed, and (6) “scapegoat the audience” faulting others for the disconfirmation process. These responses to identity disconfirmation are used within the study context to characterize students’ responses when fundamental aspects of their identity are challenged during the Environmental Science class.
This particular set of theories has been chosen as a framework for this study because of the central role of identity for adolescents, as well as suggestions in the environmental education literature that emotions play an important role in the development of one’s environmental identity (Horwitz, 1996; Kals et al., 1999). Students' environmental identity comes into question within the context of the Environmental Science classroom on a daily basis as they are being asked to question fundamental beliefs regarding how they view their own and society’s relationship with the environment. In addition to the environmental identity theories discussed below, Stryker’s (2004) identity theory of emotion, as well as McCall and Simmons’s (1978) are critical elements used in the interpretation of the results examining changes in students’ environmental identity as they proceed through the Environmental Science course.

Environmental Identity

In utilizing the symbolic interactionist theories described above, Zavetoski (2003) relates the phenomena of the individual responding emotionally to others’ reactions to the enactment of one’s identity in the environmental realm. He conceptualizes “ecological identity as that part of the self that allows individuals to anticipate the reactions of the environment to their behavior” (p. 299). However, because there is no socially meaningful response of the environment to our actions, we must therefore depend on the responses of social “others” to affirm the actions corresponding with our “ecological” identities. The term ecological identity here is used by some researchers in the field to connote a connection with the living, non-human environment that sustains us. Thomashow (1995) states that “ecological identity refers to all the different ways people construe themselves in relationship to the earth as manifested in personality, values,
actions, and sense of self” (p. 3). Others prefer the term *environmental identity* because of its relation to “environmental issues” which is seen to be a more accessible term for the average individual (Clayton & Opotow, 2003).

Although little consensus exists in the field as to which term is more appropriate, this research uses the term *environmental identity* to indicate that there are elements that go beyond the living environment incorporated into this aspect of identity. For example, Clayton (2003) defines environmental identity as “a sense of connection to some part of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the ways in which we perceive and act towards the world; a belief that the environment is important to us and an important part of who we are” (p. 46).

Finally, Harold Searles (1960) claims that especially during adolescence, the individual is dealing with a

> sense of inner conflict concerning his awareness that he is part of Nature and yet apart from all the rest of nonhuman Nature; and the two great ingredients of this inner conflict –man’s *yearning to* become wholly at one with his non-human environment, and his contrasting *anxiety lest* he become so and thus lose his own unique humanness. (p. 114, emphasis in original)

Here Searles is essentially stating that we can only truly come to know ourselves through struggling with our relation to Nature and non-human others. In this study, *environmental identity* is viewed as being influenced by both internal characteristics and personal experiences as well as external responses from social others.

Clayton (2003) makes the claim that environmental identities often emerge as a result of direct experience in nature causing individuals to reframe their view of themselves and their connection with the environment, which has been confirmed by data from several studies (Kals et al., 1999; Kaplan & Kaplan, 1989). In a similar statement, Holmes (2003) describes how it is the “actions, concepts, meanings, and feelings”
experienced in a specific place that allow “it to serve as a basis for or reflection of individual identity” and then adds that “perhaps place and self-hood are mutually codefining” (p. 30). Others have found that environmental identities can emerge from an intersection of moral and social responsibility (Kals & Ittner, 2003; Marcia, 1980; Zavestoski, 2003). Another argument has been made by Cronon (1996) that in the digital age, we must consider what young people are viewing on the television, internet, and the media regarding environmental destruction if we want to fully understand the genesis of an environmental consciousness.

One of the most thoroughly explicated theories of the development of environmental identity comes from Kempton and Holland (2003). According to Kempton and Holland (2003), there are three interrelated aspects of environmental identity formation. One aspect of development is a new awareness of environmental issues, whereby an understanding of environmental threats becomes more salient. In their study of environmental activists, interviewees often describe this stage of increased salience by using the word “aware” or “waking up.” This could be the result of direct experience with local environmental destruction or a connection with a larger environmental issue. As individuals move through different aspects of development of their environmental identity, Kempton and Holland refer to these identity processes as “reformulations.” The second type of reformulation occurs when an individual gains a sense of empowerment, during which she acquires a sense of agency, or a belief that one can act effectively either alone or as a member of a group. Kempton and Holland (2003) found that those that identify themselves as environmentalists have acquired this sense of empowerment by taking on a role where action was a necessary part of one’s environmental involvement.
In some cases, taking part in an environmental event or activity brought about an increase in *salience* or awareness of environmental issues and therefore, an adjustment in one’s environmental beliefs and values, rather than the other way around. A third type of reformulation occurs as one becomes more active in the environmental movement by carrying out actions and engaging in environmental practices. At this stage, an individual often becomes more knowledgeable about how to be an effective activist through the mentorship of more experienced others with common values.

Within this theoretical framework for the development of an environmental identity, it is important to note that Kempton and Holland (2003) include environmental action as a fundamental part of one’s environmental identity. Others see environmental identity as a motivating force that will guide personal, social, and political behavior (Clayton, 2003). Interestingly, Burke (1980) argues from a symbolic interactionist perspective that an individual’s identity is linked with their behavior, to the extent that one can better predict how others will behave through an understanding of their identity. Turner and Stets (2005) explain this piece of Burke’s theory as follows, “The meaning of an identity implies certain behaviors, and the behaviors confirm the identities that people claim” (p. 124). Similarly, for Kempton and Holland, action is not only seen as an outcome of increased *salience* and *empowerment*, but often as the experience leading to this increase, interlinking the relationship between action and identity development.

Within this study, environmental action is incorporated into the concept of environmental identity as these are seen as being inseparable as one’s environmental identity is strengthened.
For the purposes of this study, it is important to define a measure of "substantial" change in a students' environmental identity. Kempton and Holland's stages of environmental identity development are utilized for this purpose in the analysis of the study results. For example, significant movement of a student from the salience stage into the empowerment stage of environmental identity development (or from the empowerment stage into the activist stage) signifies a "substantial" change for that student. Another example of a "substantial" change would be if a student moves more firmly into the empowerment stage as a result of increased feelings of self-efficacy. This would be likely to occur if a student enters the class already participating in some pro-environmental behaviors, but strengthens her environmental identity during the course and takes on new environmentally friendly behaviors. If a student only increases the salience of her environmental identity by learning about new environmental issues without it affecting her behavior, this is not considered "substantial" change in the current study.

Another important distinction made by Kempton and Holland (2003) is the differentiation between two categories of environmental action, which they call "civic action" and "cultural reform." The first of these includes actions aimed at reforming corporate behavior or actions of the government, including membership in environmental groups, petitioning local government, or grassroots organizing. In contrast, cultural reform often occurs at the individual level as a response to consumer culture. Environmentalists in this category attempt to be role models of environmentally-friendly practices in their own lives, and may also include efforts to influence others to reform their own practices as well. In the current study, this distinction is useful in determining
which types of behaviors are being encouraged by the teacher and also being considered by the students during the Environmental Science course.

Modeling the Process of Change

Combining the above theories into a model demonstrating the process of change in students' environmental identity and associated behaviors during the semester results in the diagram represented by Figure 1. The left side of the diagram shows the factors influencing the students' environmental identity before entering the class. These factors are taken from the studies discussed above, especially those of Kempton and Holland (2003) and Zavetoski (2003), and include experiences in nature, often when they were younger; familial environmental background; prior school experiences related to the environment; and one's own environmental practices. The center box in the diagram represents the environmental identity of the students' interacting with the classroom structures, including teacher and peer relationships as well as course content, as would be expected from a sociocultural perspective. The final box on the right side of the diagram represents the resulting changes in each student's environmental identity and pro-environmental behaviors.

Missing from this model is an understanding of how students' emotions and willingness to think critically about their own beliefs affect the process of change. Given the evidence, however, of a connection between identity and emotion as is discussed in Stryker's (2004) and McCall and Simmons' (1978) identity theory of emotions, it was hypothesized that emotion may have a significant role in determining whether change in environmental identity occurred for individual students. We will revisit this model in our discussion of the results.
Methodology

Setting and Participants

This study was conducted at a public high school in the Northeast, chosen based upon inclusion of an Environmental Science elective course in the school’s schedule, teachers’ willingness to participate, a diverse socioeconomic student population, and proximity to the research university for accessibility purposes. The school is located in a suburban neighborhood, but is attended by students from rural areas as far as an hour and a half away. The high school serves 1700 students with 23% eligible for free or reduced

Figure 1: This diagram portrays a model based on research on environmental identity showing how an individual's environmental identity when entering an environmental science class (left box) would interact with classroom structures and course content (center box) in order to determine whether change in the individual’s environmental identity and associated behaviors is likely to occur (right box).
lunch. In 2006, the school had an 80% graduation rate, with 38.1% of students going on to four year colleges or universities, and in 2007, 101 students dropped out of school, representing 6% of the student population (http://www.city-data.com).

The participants in this study were 10-12th grade high school students (N = 17) in an Environmental Science elective course, as well as their teacher, referred to in this study as Mrs. P. The class was considered the lower level of two Environmental Science classes offered at the school. Students had varying levels of participation in the study on a voluntary basis, including participation in the class, surveys, interviews, and/or cogenerative dialogues. Ten students were interviewed over the course of the semester, and the results of interviews with four of these students are reported in the Results section below. These four students were chosen because they represent a variety of different environmental backgrounds, experiences in the class, and reported changes in their environmental identity and pro-environmental behaviors.

Data Collection

Since the major goal of this research is to explore the sociocultural elements that are influencing learning in students in an Environmental Science classroom, an ethnographic methodology has been chosen that allows for analysis at the individual and collective levels in the classroom setting. The research questions are explored through a subset of the following qualitative research strategies including: participant observation, videotaping, formal interviews, and cogenerative dialogues. The first layer of data collection, which can be characterized as ethnographic description, includes both participant observation and videotaping. The researcher attended class on a daily basis throughout the semester, allowing the researcher to observe the enacted curriculum. Field
notes were kept daily in a field journal, including both reflexive and reflective sections (Emerson, Fretz, & Shaw, 1995). Observations focused on relationships and interactions among participants, both peer-peer interactions and student-teacher interactions, as they participated in classroom activities. Additionally, monitoring students’ reactions to teaching strategies and activities provided insights that were explored at a deeper level through the other research methods. The class was videotaped approximately two times per week, specifically during interactive activities when there was discussion between teacher and students. The videos provide a record of classroom activities that serve to augment field notes, and were used to prompt discussion during interviews and cogenerative dialogues.

A second layer of data was collected through formal interviews and cogenerative dialogues. A diverse sampling of ten students and the teacher were interviewed during a series of three interviews at the beginning, middle, and end of the semester. Each interview ranged from 30 minutes to an hour in length, and all interviews were audio-taped for later transcription and analysis. The first interview with the students focused on participants’ environmental background, initial impressions of the course, and students’ environmental beliefs and behaviors when they entered the class. The second interview probed more deeply into students’ environmental background and beliefs, in addition to focusing on students’ reactions to activities in class and peer-peer and teacher-student interactions. The questions during the third interview explored how students’ environmental beliefs and behaviors changed (or did not change) during the semester, which activities students’ found to be most influential, and what the affordances and obstacles were to change occurring. The teacher interviews focused on the teacher’s
environmental background and beliefs and goals for the course (Interview 1), teacher's assessment of how various activities were affecting students (Interview 2), and whether the teacher’s goals for the course had been met, and the obstacles and affordances to accomplishing these goals (Interview 3).

Eight students, most of whom were also interviewed, participated in cogenerative dialogues. Cogenerative dialogues, which are group discussions amongst stakeholders (e.g., teachers, several students, and administrators), “afford the examination of shared experiences within a field—a physical and temporal place where individuals interact with each other—in order to co-create new culture and/or amend that culture which already exists, as a means to improve the quality and efficacy of teaching and learning” (Bayne, 2008). The dialogue groups of three students, myself, and the teacher met approximately once per week, every other week during the semester. The purpose of the dialogues were twofold in this study, serving both as a research tool for the researcher to gain insight into the reactions of students to various classroom structures and activities, as well as a method of improving the teaching and learning in the classroom by providing a setting where students and the teacher could openly discuss what was working and not working in the classroom and make suggestions to better their experiences in the classroom.

In addition to these qualitative methods, a survey was given to students in a pre/post format at the beginning and end of the semester to measure the change in students' environmental attitudes and behaviors. This research utilizes an established survey for measuring environmental attitudes, the New Environmental Paradigm (NEP) scale (Dunlap et al., 2000), in order to measure attitudinal change over the course of the semester. Behavioral change in students was measured by a second survey based on the
Zerofootprint: Kids Calculator, which is an “ecological footprint” providing information about the students’ pro-environmental behavior (www.zerofootprintkids.com/kids_home.aspx). The same pre- and post-test survey was given to all students, and consisted of two sections: (1) 15 Likert-scale questions scored from 1-5 (5 being the most proenvironmental orientation) from the New Environmental Paradigm (NEP) scale that measure environmental attitudes (views about humanity’s ability to upset the balance of nature, the existence to limits of growth for human societies, and humanity’s relationship with the rest of nature), and have been previously tested for validity and reliability (Dunlap et al., 2000); and (2) 30 questions from the Zerofootprint: Kids Calculator, an “ecological footprint” whose language has been modified for appropriateness for 10-12th grade students in order to provide information regarding students’ environmental behavior (scores range from 5-35). The behavior scale has the lowest score indicating the least impact on the environment, while a high score indicates a relatively larger “ecological footprint.” In order to establish test-retest reliability for the behavior survey, there were 30 questions on this portion of the survey given to the students; however, only 15 of them were actually elements that a high school student could feasibly change. For example, questions asking about whether or not the student has a pool, how many loads of laundry the family does, etc, were unlikely to change. The 15 potentially changeable items were regarding things such as turning off light or the television, recycling, how a student traveled to school, etc. By correlating the 14 “non-changeable” items on the pre- and post-tests for all students, it was possible to determine the reliability of the survey, which was 0.752 (p<0.05). The 15 “changeable” items were used to calculate the ecological footprint of each student on the pre- and post-tests.
Data Analysis

In order to document the process of change in students’ environmental identity and pro-environmental behavior, several techniques for analysis were used to ensure the rigor of qualitative research, including multiple data sources, multiple levels of analysis, code checking with other qualified researchers, as well as member checks with the teacher and several of the student participants in the study (Creswell, 2003; Guba & Lincoln, 1989). Analysis of the data occurred in several stages, beginning with analysis of the student interview data using NVivo 8 software. Open coding was originally used to generate codes and categories. Through this process, several themes emerged which were common across the different students, including: (a) environmental background, (b) openness to new environmental information, (c) thinking critically about environmental issues, (d) environmental behavior coming into class, (e) changes in environmental behavior, (f) ideas about environmentalism, (g) attitude towards school, (h) relationship with the teacher, (i) relationships with peers, and (j) how the student was influenced by the research.

Next, “focused coding” (Charmaz, 2006) and continual comparative analysis was performed with the three interviews for each of the 10 students interviewed. Subthemes then emerged within the categories listed above. For example, within the category of “changes in environmental behavior” subthemes emerged related to changes in reasons for environmental behavior; changes in small, daily tasks (such as leaving the tap water on less while brushing teeth); more significant changes in more culturally-embedded behavior (such as reducing one’s eating of meat). The themes and subthemes were coded for accuracy by a fellow graduate student in the education department to ensure reliability.
of the coding procedure. There was a 98% overlap in the distribution of codes, and the final 2% were discussed and negotiated.

Third, the videotapes of the cogenerative dialogues were viewed during a meso-analysis at regular speed, while recording a chronology of topics being discussed. Segments that served to substantiate or contrast with findings in the interview data were noted. During a subsequent micro-analysis, these vignettes were transcribed verbatim, and coded according to the emergent themes and subthemes described above. No entirely new themes emerged; however, several subthemes were added under the themes of peer-peer interactions and teacher-student interactions, including subthemes regarding leadership in the class and views of the teacher depending on whether she was perceived as being either one-sided or balanced in her presentation. Another subtheme emerged under the larger theme of “critical thinking about environmental issues,” which was whether students’ felt a connection with national or global environmental issues being discussed in class. Additionally, field notes and classroom videotape were reviewed to ensure agreement between data sources.

Finally, the structure and theoretical framework of the identity theories of emotion and the development of environmental identity enhanced the stages of analysis by providing a common approach in the comparative analysis of the students’ experiences. This theoretical framework along with the student data was used to create the more detailed model in Figure 2 which provides an overview of the process of change experienced by these students during the semester. The students whose interviews were chosen for use in this paper were asked to review the section describing the results relating their experience. Three out of the four students participated in these member
checks and any concerns expressed by the students were carefully considered. The findings are reported in the section below.

**Results**

The following findings are focused on the experiences of four students in the Environmental Science course. The results for each student are divided into sections corresponding to the parts of the model presented in Figure 1. The first of these sections focuses on the environmental identity and background of each student when he/she began the course. For each of the students highlighted in the results, different factors have contributed in more or less meaningful ways to the student’s environmental identity formation.

The second section corresponds with the center circle/box in the model where each student’s environmental identity is interacting with structures within the classroom, including course content, teacher and peer relationships, and other elements of the class culture. Through these various interactions, the student’s environmental identity has the opportunity to be affirmed or disconfirmed as students participate in the various classroom activities. Interactions with other aspects of the students’ identity, including his/her consumer-materialist identity, a term integrating the ideas of Dittmar (2007) and Dittmar et al. (2007), social identity, and student identity also come to the forefront. These results are presented when their influence upon the student’s experience was significant. Referring to Stryker’s (2004) identity theory of emotions, an emotional response from students in reaction to a certain activity or discussion is often an indication of their identity being affirmed (positive emotional response) or disconfirmed (negative emotional response). This emotional response was recorded as either verbal during
interviews or cogenerative dialogues, or as a physical reaction, as noted in field notes or during analysis of classroom video. Only the verbal emotional responses described by students during their interviews are presented here.

The third section for each student corresponds with the final box on the right side of the model representing the resulting changes in each student’s environmental identity and pro-environmental behaviors. There are several types of changes experienced by students, and these four students are presented in the results because each student exemplifies a different one of these changes. These changes will be further explored in the discussion following the results. Additionally, amendments to the model in Figure 1 are proposed in the discussion section, in accordance with new findings described in the results.

The Students and the Process of Change

Captain Planet (C.P.): The thoughtful critic. Environmental background. C.P. comes into the class with a strong environment background, which is a result of spending time outdoors, reading, and discussions with his parents. His environmental attitude score was 3.80 (on a 1-5 scale) at the start of the semester. C.P. says that spending time outdoors was encouraged by his parents while he was growing up:

Yeah, I’ve lived in the same place my entire life, and there’s, you know, there’s a nice little woodland area down the road, quite literally, you go down my road, and the Salmon Falls River is right there...well, my mom did-, you know, when we were younger, when me and my brother were younger, she would go down there with us, yeah, both my parents, both my mother and my father have always encouraged you know like being outdoors and we’d go hiking and stuff. (Interview 1, 2/19/09)

C.P.’s family does several environmentally-related behaviors, and it is evident that C.P. sees his mother as initiating these environmental behaviors, but views himself as an active participant, “I mean, my mom isn’t really part of any organization that is
environmentally active, but we try to-, but I mean we recycle a lot, we use organic cleaners, cleaning products, and she’s gradually replacing all the light bulbs with the fluorescent, yeah…. And we compost, yeah, my mom’s very big on gardening” (Interview 1, 2/19/09). Accordingly, C.P.’s environmental behavior score was one of the lowest in the class at the start of the semester at 11.5 (within a 5-35 range), indicating one of the lowest “footprints” in comparison with his classmates. Due to C.P.’s pro-environmental behavior for which he understands the environmental reasons, he has already entered into the *empowerment* stage of Kempton and Holland’s (2003) stages of environmental identity development where personal action is undertaken. In discussing the major environmental influences on him, C.P. also mentions his freshman year Earth Science teacher and he says that this teacher’s “respect and enjoyment for the environment kind of rubbed off on me, I guess” (Interview 2, 4/7/09). Notably, C.P. is the only student to mention a previous teacher as a strong influence on his environmental beliefs. Additionally, C.P. is one of only two students that took this class primarily out of interest in environmental issues, and whose goals in taking the course involved wanting to learn how he can live in a more environmentally-friendly way, and already has ideas to do so in the future: “Just like, like when I start living on my own and stuff, I really kind of want to live like a more green lifestyle, and one thing I’m interested in is like the whole self-sufficiency thing, like raising your own food and stuff” (Interview 1, 2/19/09).

The *middle circle: Identity and classroom strictures interacting*, C.P. expresses the integration of his environmental identity and consumer identity as a statement of his belief in wise-use practices that take the environment into consideration: “Okay, I’m very much, you know, in favor of preserving the environment, and I think that as long as
environmental resources are used in a sustainable and a responsible way, then I don’t see why we shouldn’t use them (Interview 2, 4/7/09). During class, C.P. is very engaged with the course content and maintains one of the highest grades in the course throughout the semester. He often exhibits critical reflection upon the issues discussed in class and the teacher’s approach in presenting these issues. He considers arguments he hears in class and tries to figure out how they fit in with prior knowledge that he has. For example, C.P. states the following during his second interview:

Yeah, and a lot of the stuff with the logging also made me think about how complicated the issue is, you know, not only is the environment at risk, but there’s also the livelihood of people, and the stuff about DDT, um, yeah, I mean it’s-, [sigh], I mean it kills birds and stuff, but I mean she didn’t bring up the fact that if you have a choice, if you lived in a third world country or a developing country, whatever they’re calling them these days-, if you lived in a country like that and your choice was either spray DDT and be able to grow crops and not have your family or yourself die of malaria or not spray DDT and, you know, have insects eat your crops and have you or your family die of malaria, I would spray DDT, and she just doesn’t address that, which kind of makes me angry...Like she doesn’t address the fact that a lot of times [sigh], yeah, a choice is environmentally poor, but to a lot of people it’s the lesser of two evils. (Interview 2, 4/7/09)

This selection also is an example of a common theme expressed by students throughout the interviews, which is their desire for the teacher to present a balanced approach to the environmental issues. Here, C.P.’s critical thinking skills lead him to the realization that there are other sides to the issue that Mrs. P is not presenting, and this evokes a negative emotional response from him. Throughout the semester C.P. regularly argues with Mrs. P during class discussions led by the teacher in a Socratic dialogue manner. However, he consciously “eased up on her in a way” (Interview 3, 6/4/09) by the end of the semester, and leaves class with a positive opinion of her and even sees her as a role model as he finds himself “agreeing with a lot of the stuff she says” (Interview 3, 6/4/09). It is worth noting that C.P. rarely mentions grades during his interviews, and this does not seem to
be a factor of primary concern in C.P.'s relationship with the teacher, as he maintained high grades throughout the course even as his relationship with the teacher changed, as noted above.

This next vignette is another example of the process of critical thinking about an environmental issue, as C.P. expresses an internal conflict regarding what he perceives to be an acceptable answer by cultural standards of society, but he is unsure if this is in line with his own moral judgment. In response to C.P.'s strong agreement with the statement “Trees have as much a right to exist as humans,” the researcher presented C.P. with a scenario of being stranded on an island with only five trees and no shelter. When asked if he would cut down the trees or not, he quickly says, “yes” but then continues with this thought process:

C: [Sigh]...I'm not sure, you know, I'm...I mean, culturally it's okay, socially it's okay, you know, my instinct says cut the trees down, but I'm not sure, you know, that's like a pretty deep philosophical question.
E: M-hm, so what's your hesitancy? What are you thinking about?
C: My hesitancy is because I think, like I said earlier that everything has a right to live, but should, but I mean, the fact is that just about everything in nature, yes, everything does have a right to live, but I mean just about everything in nature consumes something else in order to live except for certain kinds of plants that just use sunlight. I mean, even something like a strangler fig, that's a plant, but it still, in order to complete its life cycle, it still kills another tree, so, yeah, I mean, competition and, you know- (Interview 2, 4/7/09)

Here C.P. is struggling to develop his environmental identity, as he questions his own values regarding the rights of nonhuman “others.” This vignette demonstrates that individuals do not make environmental decisions in a vacuum, but are forced to contend with societal expectations regarding our actions in every situation.

Identity affirmation and disconfirmation and associated behavior change. C.P. enters the class thinking of himself as an environmentally responsible person until he takes the ecological footprint (separate from the research behavior survey) as part of an
in-class assignment, which makes him realize he has a ways to go, as he states: “Like when we took the ecological footprint quiz, I got something like 6.5 Earths, and I was a little surprised, and I wasn’t sure like what I could do to change that beyond-, like I mean there’s only so much that I can do, you know, as a teenager to change my lifestyle” (Interview 1, 2/19/09). C.P. expresses frustration here, and exhibits a common response to environmental identity disconfirmation, which is what McCall and Simmons (1978) call “scapegoating the audience” where the individual blames others or external aspects of their situation for the discrepancy. However, rather than letting this sense of a lack of self-efficacy discourage him, C.P. finds a sense of empowerment through this class and ultimately ends up changing a significant behavior which is giving up eating meat during all his lunches. In C.P.’s third interview (6/4/09) he attributes this decision to activities in class:

E: M-hm, yeah, and, um, so how did the PETA movie affect you?
C: It was kind of like disgusted by like what goes on in there, and I have been like cutting down on meat that I eat.
E: M-hm, yeah, as a direct result of seeing that?
C: Yeah.
E: Huh, okay, so that really struck you pretty harshly.
C: M-hm, I mean I still eat meat, but, you know, I like, I try to eat less, so like instead of bringing a roast beef sandwich, I’ll have, you know, P.B. and J.
E: M-hm, m-hm, yeah, that’s a really big step for you, C.P., cause you’re a pretty big meat eater, and was there anything else that kind of influenced you to do that, to start eating less meat?
C: Like some of the stuff Ms. P talked about, about how like, you know, they have to like cut down the rainforest and then they put in pasture land for the cows and stuff, and then like the King Corn thing, there was some influential [things] in that.

C.P. does comment upon reviewing this quotation that he also uses the strategy that McCall and Simmons call “short-term credit” where he ignores what he has learned in class in order to keep eating meat with his family at dinner (e-mail correspondence, 2/10/2010). Therefore, it seems there is a limit to the change C.P. is able to make in
2/10/2010). Therefore, it seems there is a limit to the change C.P. is able to make in response to this new information.

Overall, C.P. says that the class “cemented” his environmental views (Interview 2, 4/7/09), and even caused him to feel more strongly on certain issues. For example, when asked whether he agreed or disagreed with the statement, “The so-called “ecological crisis” facing humankind has been greatly exaggerated” C.P. replies:

C: I disagree because I mean, we are in danger cause we’re wiping out species by the dozen, you know, and, any one of those could-, we’re polluting, we’re filling up our planet with trash, we’re, you know, punching holes in the ozone layer, we’re, you know, heating up the planet.
E: Uh-huh, yeah, okay, so you don’t think that-
C: Don’t give me any of this “so-called crisis” B.S.! Don’t give me any of that “there is no global warming.” Yeah, shut up.
E: Does that make you angry?
C: Yes, it does.
E: Okay, so you, you would say you strongly disagree with that statement.
C: Yes, I strongly disagree with that.

C.P.’s response is noteworthy here because he gets quite emotional, showing that he is feeling more strongly about environmental issues as a result of the class. By the end of the class, we see C.P.’s environmental identity being strengthened, and his willingness to adjust certain culturally-embedded behaviors (in this case, meat-eating) indicates that he is moving further into the empowerment stage of environmental identity development (Kempton & Holland, 2003) where action is a necessary part of one’s environmental involvement. During the semester, C.P. did not change his environmental attitude score drastically (an increase of 0.07 points), but he did reduce his ecological footprint score by 2 points.

Overall, C.P. came into the class with a strong environmental identity resulting from his familial interactions and time spent outdoors. Utilizing his critical thinking skills, C.P. critically assesses the arguments he hears in class and utilizes this new
information in questioning his own assumptions, values, and behaviors. The class serves to strengthen his environmental values, while disconfirming aspects of his consumer-materialist identity. C.P. gradually begins to feel empowered to take action in his own life to mitigate this discrepancy between his feelings and his actions, marking a substantial change in his environmental identity development (Kempton & Holland, 2003). His decision to stop eating meat during all lunches was a significant step for him in furthering this commitment to his environmental identity.

Kat: The emotional responder. Environmental background. Kat has developed a respect for nature as a result of the small amount of time she has spent in the woods and her religion, which has a deep respect for the Earth. She has been exposed to this religion through reading. The time she spends in nature is limited due to severe allergies when she comes into contact with trees and grass. She has a strong preservationist ethic, which is more extreme than the teacher in some cases, as is documented below. Her score on the environmental attitude survey is 3.6 at the start of class, and like C.P., Kat is taking the Environmental Science course because of an interest in the subject. Kat’s immediate family members in her home are quite excessive in their consumptive behavior, maintaining for four people eight computers, four televisions, a Wii, an X-box, a Play Station 2, five I-pods, in addition to buying excessive amounts of food that often “go bad.” Kat discusses trying to get her family members to change their behavior without much success, and states that one of her goals for the course is “to make my family realize just how consuming we are” (Interview 1, 2/12/09). She does plan on moving out of her family home to live with her boyfriend, and plans to reduce her consumption level immensely, of which her boyfriend is supportive. Kat does several environmental
behaviors at the beginning of class, including recycling, buying organic food, turning off the lights, computer, and television, and seems to realize the environmental significance of each of these actions. This places her into the *empowerment* stage of Kempton and Holland’s (2003) stages of environmental identity development at the beginning of class. These behaviors are reflected in her very low footprint score on the initial environmental behavior survey with a score of 10.5.

**The middle circle: Identity and Class Structure Interactions.** Overall, Kat is critical of the class - it is too slow, and there are too many disruptions (she is very frustrated with other students in the class). Kat states during her second and third interviews that these disruptions make it difficult to learn in the class. She struggles with her grades throughout the course as a result of this, as well as personal issues related to depression which caused her to miss a week of class. Kat is also critical of Mrs. P for not being open to other opinions and sometimes being hypocritical. She notices the hypocrisy here between the assignment, which is to use paper to make a pamphlet about protecting the rainforest, and the message of the assignment, which is the need to save the trees:

K: Cause she’s all like, “Save the trees, save the trees, save the trees, here’s a pamphlet about how to save the trees.” That’s just kind of hypocritical.
E: Because you’re using the paper to say save the trees.
K: Yes. Come on, if you want to save the trees, like write it on the board, do something.
E: Use the computer.
K: Use the computer. Do something other than using paper. (Interview 2, 4/8/09)

During a cogenerative dialogue two months into the semester in which the teacher was not present, Kat and another student (S) discuss their frustration with Mrs. P in the following vignette. When asked their current opinion about the class, Kat responds:

K: I kind of don’t like it.
E: You kind of don’t like it now. Why?

168
K: Cause she’s [Mrs. P] all like, “Please, think free, think free,” but if we bring up our own opinion, she’s like, “No, that’s wrong. I don’t like it. Listen to my opinion.”
S: But she says it indirectly. She doesn’t say it in that way. She just says like, “No, please don’t think that way” or “That isn’t right” or something like that. She tries to say it in a nice way.
K: Yeah, me and C.P. talked about this after class, and it’s-, she’s like, “Please think free, but, hey, think my way first.”
S: Exactly. (3/19/09)

This one-sided feeling about the teacher occurred in at least four interviews (and two cogenerative dialogues—without the teacher present) with students mid-semester, including Kat’s second interview. This vignette represents an interesting example of how an individual’s expectations of herself as a student and the teacher in particular “performance roles” can affect one’s feelings towards the teacher and the class if these expectations are not met. However, by the end of the semester, Kat and most other students came to see Mrs. P as fairly representing multiple sides of the environmental issues. By the end of class, Kat returns to an overall positive opinion of Mrs. P and her teaching strategy, stating that, “For me, if a teacher is passionate about what they’re teaching, I tend to learn more, so it works better for me”(Interview 3, 6/10/09). Kat also adds that she pretty much agreed with most of what Mrs. P was teaching, but she did not feel like the class changed her environmental views because she already felt strongly about protecting the environment. Interestingly, Kat scores one of the highest grades in the class on the final exam, indicating that her comprehension of the issues was significant, despite her academic and personal struggles throughout the semester.

Identity affirmation and disconfirmation and associated behavior change. Kat's consumer-materialist identity, which had already been losing salience for her prior to the class, is disconfirmed by activities early in the semester, which affects her quite
emotionally. This vignette shows that the class increases Kat's awareness of both population issues and consumption issues:

K: Um, what else, oh yeah, population – I was surprised it was that large because I used to live in Georgia, and there's hardly any people there, so I haven't had a lot of contact with people, so imagining 6.7 billion people just makes my head hurt.
E: Right, so was that surprising to you today, that activity, when you did the ecological footprint?
K: Yes, well, I was surprised because Americans take up at least 7 Earths, and then I was sad because, I don't know, I'm one person, and for everybody to live like me, you would need like 3.15 Earths.
E: Right, yeah, it's pretty shocking, huh?
K: Yeah, I think I started to cry in class.
E: Oh, so does that make you want you to like change anything you're doing, or what does that make you think about?
K: Economically I really can't change anything because of the pressure.
E: Yeah, so does that make you feel, sort of like frustrated, or-?
K: Yeah, because I'm stuck between a rock and a hard place. I can't change, but, you know, I want to. (Interview 1, 2/12/09)

Much like C.P. at the beginning of class, Kat feels limited as to what she can change in her own life. Here she exhibits a similar response to C.P.'s original response, which could be categorized as “scapegoating the audience” (McCall & Simmons, 1978) where she is blaming external circumstances (i.e. her living situation) for the negativity she is feeling. The effect of the class on Kat seems to be moving her further into the empowerment level of environmental identity; however, rather than changing a more culturally-embedded behavior like meat-eating, Kat decides to change many smaller behaviors to reduce her footprint, no longer “scapegoating” the issue, but doing what she can to make a difference.

E: And anything else that you changed right after that [the ecological footprint activity]?
K: Um, I use less water in brushing my teeth. I don't let the tap just run.
E: Right, right.
K: Um, this is going to sound gross, but I shower every other day.
E: Yeah, I don't think that's gross.
K: Okay, some people are like, "You don't shower every day. That's so dirty.”
E: Yeah, but is that a change, or you already did that?
K: It’s a change. I used to take three showers a day.
E: Huh!
K: Yeah, during the summer time. During the winter, I might take more.
E: Wow, okay, and this semester you’ve reduced that.
K: Yeah, dramatically.
E: Yeah, okay, anything else that you’ve noticed?
K: Um, I use scrap paper, like I’ll use the back of something to write something else on, instead of just taking a new sheet.
E: And you already recycled before?
K: Right. (Interview 3, 6/10/09)

Although clearly conscious of how the behavior change in showering would be perceived by others, these behavior changes are mostly those that Kat can make on her own because they do not require the support of others. This is an important example of the types of changes that are feasible for individuals to make on their own, and for many this may be the extent of what is possible given their circumstances.

The next two sections demonstrate the conflict that resulted for Kat when being asked to reduce her meat-eating through the “subtle influencing” of the discussions in class. During the second interview (4/8/09), Kat describes trying to go vegetarian for a day, but without the support of her family, she finds this very difficult when she gets home:

K: …I got a salad for lunch, and I had already ate fruit for breakfast, and then I get home, and I have a banana, and then I was all like, “Mm, I’m doing pretty good” and then my mom made the steak, and she made it the perfect way too.
E: Oh, did she know that you were trying to-?
K: No, and most of our meals are meat meals.

By the third interview (6/10/09), Kat is admitting that she is now ignoring information that she is learning in class, using the strategy called “short-term credit” by McCall and Simmons (1978) to respond to the disconfirmation of her identity. She does acknowledge that it is hard for her to see the animals being killed for her food, but she is able to ignore it when she is eating:
E: Yeah, so why not? Why don’t you think you could give up meat?
K: I just love meat. I had a steak over the weekend. It was nice.
E: So, like when you saw the PETA movie—?
K: [Sigh] Ugh, it made me sick, but only for reasons because I don’t like seeing animals hurt.
E: Right, but do you realize that to get the steak on your plate—?
K: Yes, I just don’t think about it [K is clearly upset in her voice].
E: So you just ignore that. Yeah, so what do you think that’s about? There’s like some separation between when it’s on your plate—?
K: Yeah, when it’s on my plate, it doesn’t have a face. When it’s on my plate, it’s not breathing or moving, but when it’s in the fields, it’s cute and cuddly, or in the water, and it’s just cool.
E: Yeah, so you just separate that.
K: It’s very separated.
E: Yeah, so that seems like you’re a bit disturbed about that.
K: Yes.
E: So that’s kind of hard for you.
K: Yes. (Interview 3, 6/10/09)

Kat is a great example of a student who is willing to critically reflect upon and consider changing some aspects of her lifestyle after her consumer identity is disconfirmed, but there are others she is simply not willing to change at this point in her life. During the semester, Kat increases her environmental attitude score by 0.70 points, which is substantial on a 1-5 scale. Surprisingly, her behavior score actually increases by 2.5 points, despite all the behaviors she talks about changing, several of which are on the survey. One possible explanation for this increase is that she underestimated her ecological footprint on the pre-survey, which is likely given the lack of environmental support within her household. One of the major differences between Kat and C.P. is parental support, which Kat does not have. Kat has had to reject the consumptive values of her family, but she has done most of this work before the class began. Interestingly, both of the students are able to find ways of adjusting their behavior once they realize there are a number of ways to do so that are in their control. Their level of empowerment is thereby enhanced as they realize there are actions that can be enacted even within their
limited circumstances as teenagers living at home, signifying a substantial change in their environmental identity development. Both Kat and C.P. see themselves as budding environmentalists, indicating that they will take their environmentalism to new levels in the future.

Greg: The Positive Influence (Motorcycle Tech Kid). Environmental background. Greg grew up spending time outdoors doing recreational sports like biking, riding motorcycles, snowmobiling, in addition to hunting and fishing. These activities were introduced by his dad. Greg's environmental identity coming into the class is mostly based on these outdoor recreational experiences, which he realizes are not eco-friendly. His environmental attitude score of 3.20 is the lowest of the four students reported in this paper coming into the class, but this score is still on the pro-environmental end of the scale. Although Greg comes into class with limited environmental knowledge on the issues discussed in class and is taking the course primarily as an alternative to Chemistry (which he had previously failed), he realizes that "the Earth is kind of going down" and is quite open to learning new information about the issues and "broadening [his] view" (Interview 1, 2/17/09). His lack of environmental knowledge and reasons for doing environment-related behaviors at the start of class ("to help my parents out") indicates that he is low in the salience stage of environmental identity development (Kempton & Holland, 2003). In terms of environmental behaviors, Greg states during the second interview (4/15/09):

G: I do my part, try to recycle, shut the lights off, don't litter and everything, but still I drive all over God's creation, and I drive everywhere and I ride four-wheelers and dirt bikes and snowmobiles and just rip up the Earth's surface, so- It would take like, what was it, seven and a half Earth's to support me.
E: Right, so you think even the few small things you can do won't counterbalance-
G: Yeah, no way, cause I still eat cheeseburgers like you wouldn’t believe and pizza.
E: Yeah, and you don’t foresee those behaviors changing?
G: No. I’m definitely a gearhead. I’ll always have toys and stuff…

This vignette is reflected in Greg’s score of 18 on the initial environmental behavior survey, which indicates that he did partake in some pro-environmental activities at the start of class as mentioned during this interview. Greg adds during the first two interviews that he is open to changing some of his behaviors, although there are some he will not consider changing (including his outdoor recreational hobbies, driving, and meat-eating).

The middle circle: Identity and class structure interactions. Greg is an example of a student that often non-critically accepts the environmental information Mrs. P presents in class, a notable interaction between his environmental identity and the course content. For example, when he is asked during each of the interviews if he agrees with Mrs. P’s point of view and the information she is presenting, each time he replies similarly:

G: I could agree because, you know, that really happens. I mean she wouldn’t say it if it wasn’t true, really, some of the stuff. I mean there’s nothing that was like, “Oh, no, you’re wrong, totally wrong. I don’t believe that one bit.”
E: Right. So you find her pretty convincing and the facts she presents?
G: Yeah.
E: Yeah, okay, is there anything that you can think of where you really disagreed with what she was presenting?
G: Not that I can think of, like…Not that I know of. (Interview 2, 4/15/09)

In addition to accepting this new knowledge, Greg exhibits a thorough understanding of many of the issues learned in class on his exams, on which he does consistently well throughout the semester. During the interviews, he also remembers the details of many of the issues several months later. As an example, after viewing the movie King Corn during class mid-semester, in his final interview (6/3/09) Greg recalls this movie as having a significant influence on him:

174
G: Say if I didn’t take the class at all, I wouldn’t know that it was making such an impact on what we’re doing, like we watched the *King Corn* video - that was a pretty good one too. It showed that all that corn, you know, what was it, it was Iowa, right? An Iowa farmer can’t grow, you know, can’t have a farm to feed his family, cause they’re just growing for cattle or for ethanol use, or just the corn syrup that’s in every soft drink. It’s such a big impact, like none of that corn goes to like actual eating it as corn.

E: Right, right.

G: It’s just weird, so that just shows you how much of it is being used cause there’s corn, like those big towers, they just filled right up. That’s insane...So it makes you think, it’s like that building is five stories tall, and you use it within, you know, however long it takes, it just doesn’t last. Every single year, it’s like, there’s not leftover corn, so, I mean, it’s pretty incredible.

This vignette shows how the salience of Greg’s environmental identity is augmented as he gains an awareness of issues he knew little about prior to this class. This could be interpreted as an example of Paul and Elder’s (2001) openness to new ideas as a characteristic of critical thinkers; however, Greg exhibits limited skepticism, questioning, or assessment of this new information and how it fits in with his own values and behavior, thereby exhibiting little critical thinking after exposure to these environmental ideas.

Additionally, Greg consistently has positive experiences in the class, more so than almost all other interviewees, in terms of his view of the activities in the class, his achievement level, and his relationship with Mrs. P. Greg is seen by Mrs. P as a leader and role model in the class, and he participated throughout the semester in cogenerative dialogues with Mrs. P and other students. During her third interview (6/25/09) Mrs. P states:

I think Greg is, he’s thoughtful about things, and he was pretty much, at least voicing a kind of perspective on the environmental side. You know, frequently he would do that, and he is somebody that other kids in the class would look up to, but not feel estranged from, cause he’s really-, even though he’s a little bit older, he’s kind of one of them, whereas C.P. is not really one of them. C.P.’s from a different background, and so even though the kids really admired how much C.P.
knew, they wouldn’t connect as much. So when you can get a Greg in there that

kids can feel like, “Well, if he can say that, I could say that.” Whereas with C.P.,
C.P.’s such an aesthete, and “Well, he could say that cause he’s so smart. I could
never say that.” So, you know, kids like Greg can be a real door.

From this vignette, it is evident that Greg was well-respected by the teacher and
appreciated for his positive influence on the class, affirming his social identity as a leader
in the class. Greg also expresses that he values the knowledge of the other students in the
class. Additionally, he sat next to the researcher during class, and served as a research
assistant at times, often helping with videotaping the class. These factors helped to
increase his agency and make the class a positive experience for him.

Identity affirmation and disconfirmation and associated behavior change. In
addition to the strengthening of Greg’s environmental identity through raised awareness
of environmental issues, Greg realizes the environmental reasons, rather than just the
economic, for several of his pro-environmental actions. In the second interview (4/15/09),
Greg states, “Yeah, I always shut the lights off and stuff. I mean, I’ve always done that
before, but you know, now thinking about what, you know, it’s actually using the energy,
doing it cause of the energy reasons, not just to help my parents out.” In addition to this
realization, Greg also becomes more committed to his behaviors that are affirmed by the
class, including not littering and recycling, which may move him into the empowerment
stage of Kempton and Holland’s (2003) stages of environmental identity development.

Here Greg is describing how he has changed his behavior because of the class:

G: I would say, you know, recycling and stuff, I throw my paper definitely in the
recycling bin, or opposed to I would always just go to the garbage or something.
[Now] I make the extra walk, like Mr. K, all his recyclables, all his stuff is in the
back of the room, when the garbage is literally three feet from my hand.
E: Yeah, but you make the effort.
G: But I do, I definitely do, you know, like I don’t just throw it away, I can
recycle it. So I’ve changed a lot that way, cause in the beginning of class, I was like, “Oh yeah, recycling [with a negative, sarcastic tone]” but it really makes a difference, you know, just a little one, but at least I’m going for it. I might be destructive here, so I’ll try to help myself here to kind of counterbalance, so- So that’s my point, yeah. (Interview 3, 6/3/09)

This is an example, similar to experiences discussed by several other interviewees, where a student discusses making more of an effort to carry out an environmental action as a result of the class. Interestingly, Greg shares his experience in Mr. K’s class with the Environmental Science class, where he receives praise from Mrs. P for this behavior.

It is important to note, however, that Greg continues to insist that he is not going to give up his hobbies, even if they are harmful for the environment. When asked in the third interview (6/3/09) about how the class has affected his views towards his activities like ATVing and snowmobiling, he replies, “I’m just still going to do them, you know. I’m still always going to drive a car or have a motorcycle or some type of toy, you know, so as much as it’s doing bad to the Earth, it’s just fun for me, I guess.” Additionally, Greg states during his second interview that he is not willing to change his meat-eating and tries to ignore what he is learning during the agriculture unit in class. When asked how it is possible for students to ignore this information, Greg states:

G: They just, I guess they’re not seeing a big enough impact, so they think it’s not really happening. They’re just, you know, naïve, I guess. They know it’s happening, but they just pretend like it’s not.
E: Yeah, so is that what you’re doing?
G: Sure. Yeah, I mean, hey, they might be doing it, but this cheeseburger tastes something good…I guess. (Interview 2, 4/15/09)

This reaction is very similar to that described by Kat during her interview, exhibiting McCall and Simmon’s (1978) response called “short term credit,” and seems to be a common response when one’s identity is disconfirmed by new information that creates a disturbance for the individual.
Finally, however, Greg describes during his last interview how he is relating what he has learned in class to his future career, running a machine shop:

Like using machines and stuff, all the machines, they use oil, and some job shops and some machine shops, they’re becoming more eco-friendly, like they’re conserving a lot more, they’re cutting oil, like they’re being able to reuse their scrap metal and, you know, just by doing, you know, if the shop is becoming more green, like TurboC, they’re incredible. That’s an incredible shop that they have going on over there...It’s just incredible that they can take a 55 gallon bucket filled with metal chips and condense everything, and there’s about 5 gallons of oil, they can salvage 4 and ¾ of that 5 gallons of oil without a-, and reuse it, you know, and not go to waste. I mean, that’s, that’s incredible. (Interview 3, 6/3/09)

Greg also says that he sees the connection between conserving and making money, and clearly states that he hopes to utilize this philosophy in his future business. Interestingly, Greg does not see himself as an environmentalist due to his harmful environmental behaviors that he is unwilling to give up. During the class, however, Greg increases his pro-environmental attitude by 0.33 points and decreases his ecological footprint by 3 points, further indication of the strengthening of his environmental identity as a result of the class.

Overall, Greg is representative of a student that begins the class with limited knowledge of environmental issues, and through positive experiences and an open mind, his environmental identity is substantially impacted by participation in this type of environmental course. Rather than making drastic changes in his behavior, Greg becomes more committed to activities such as recycling and not littering, which he considers feasible and worth the extra effort. Through his open commitment to these actions, Greg ultimately serves as a role model for others. It is also important to note, however, that there were several behaviors that Greg is not willing to change, even after
he is confronted with their destructive possibilities, demonstrating that individuals often have a limit as to what they are willing to do for the environment.

Rick: The nature-loving trouble child. Environmental background. Rick has grown up spending time in the woods near his house, and has a deep love of spending time in nature and the woods as a result. His environmental attitude score is 3.33 at the start of class. Here Rick speaks about his love of spending time outdoors and his dislike of development:

R: Uh, yeah, I live in Springside, and it’s nothing like Danville. There’s trees everywhere. I live in the Boonies of Springside, so I’m surrounded by woods, so I spent all my time as a kid in the woods, making forts, and climbing trees.
E: So what do you think like-, how did that sort of experience affect you in terms of how you think about the environment?
R: Well, I mean I get mad when developing starts, like when they start cutting down trees cause they have been doing that a lot, like near my house, but not on my property. It changes a lot, and just like thinking back when I was a kid, it’s changed so much already and I’m only 17. I can’t even imagine when I’m thirty. (Interview 1, 2/20/09)

Interestingly, Rick is the only student that calls himself an “environmentalist” during the first interview, and maintains this image through the final interview, despite having a very negative experience in the class. However, Rick states that he is taking this class because he has heard that it is an easier course than Chemistry, and his goal for the course is to pass and is not related to the environmental theme of the course. Rick mentions very few pro-environmental behaviors when he enters the class, with the exception of being anti-littering and recycling, which he clearly does for more economic reasons than environmental (getting 5 cents/can for recycling). This indicates a low salience of Rob’s environmental identity at the start of class because even though he seems to have an emotional connection with nature, this does not seem to transfer to other areas of his life. This is reflected in his fairly high ecological footprint score of 23.5 at the start of class.
Rick also states that he has little interaction with his parents and does not view them as environmentally active in any way.

The middle circle: Identity and classroom structures interacting. Rick enters the class with a negative attitude towards school, saying that he “hasn’t really learned much since like seventh grade” (Interview 1, 2/20/09), and the Environmental Science class, stating that “I didn’t really come in here like wanting to learn. I just wanted to pass, so-” (Interview 3, 6/8/09). However, during the first third of the semester, Rick is quite engaged in class discussions, often raising thoughtful counterarguments and exhibiting a willingness to think critically about the issues being discussed in class. During the second interview (5/4/09), Rick is clearly struggling in trying to define the interaction between his own environmental and consumer identities, as evidenced by this vignette where he is discussing his feelings about the logging issue currently being discussed in class:

Well, seeing how the loggers like, they just cut down so many trees, and I feel like loggers have to do their jobs, but seeing them [the trees] after they do their jobs-, seeing the job after they’re done just like-, it’s kind of hard to look at that and be like, “Well, there was trees there, but now there’s not” but I still believe that the loggers have to do that to stimulate the economy and stuff.

As the class proceeds, Rick becomes very turned off by Mrs. P’s approach, which he sees as being very one-sided, and less and less open to listening to her and engaging with her ideas. His negative attitude and frustration resurfaces, which he expresses during the second interview:

E: So what is your opinion of Mrs. P at this point?
R: I think she’s a very nice lady, who is very proud of what she believes in and what she does, but also very stubborn about listening to how other people live and what other people do.
E: She almost like won’t listen to another side of the issue, or something like that?
R: Yeah, yeah, that’s it.
E: Okay, so how do you think that affects your willingness to listen to her?
R: I just don’t listen to her. Unless she’s talking like out of the book or something, but if she’s like telling about her-, I don’t know like, environmentalist stories or some weird stuff like that, I just stop listening. (Interview 2, 5/4/09)

This vignette represents an example of a reaction of a student when his expectations of the “teacher role” are misaligned with his perceptions of the teacher’s practice.

Unfortunately, this tension grows throughout the course and often results in open arguments between Rick and teacher which become disruptive to the class. As this conflict grows, Rick also struggles academically and he ultimately failed the course after missing several days due to a serious injury to his arm.

Identity affirmation and disconfirmation and associated behavior change. There is only one instance in his interviews of Rick’s environmental identity being positively affirmed, and this is around the idea of poaching and animal rights, which Rick feels strongly about. After seeing a movie in class about poaching in India, Rick states that “It’s just cruel to animals, and it’s illegal, and there’s not even much being done to stop it.” He says he thinks this is an important issue “because I really feel for animals. I think animals have just as much of a right to be here as us, as humans, but I don’t think we should just be able to kill them for their skin and their horns and stuff, just cause we think they’re cool” (Interview 2, 5/4/09).

The clearest example of Rick’s consumer-materialist identity being disconfirmed is around the topic of the source of his food, which was a central theme during the unit on agriculture during the middle of the semester. Rick’s first response to learning about the sources of corn and meat is “Well, that’s just weird. I don’t want to know about that. I just want to eat my food” (Interview 2, 5/4/09), exhibiting what McCall and Simmons call “selective perception” so that only elements of a situation that affirm one’s identity
are given attention, while other ideas are ignored. However, later in the interview, Rick tries to form an argument justifying his meat-eating, but his statements are filled with misconceptions, as seen below. In the following exchange, he twists the information he has learned in class, which has disconfirmed his consumer-materialist identity:

R: I cannot agree with that [being a vegetarian].
E: Okay, why not?
R: Because the way I look at it is plants are the only things that are actually helping the world, and animals, well not animals, cows are destroying the world, and I’m eating a cow and you’re eating a plant. Doesn’t that-, isn’t that weird? Like I’m eating a cow which is destroying the world, and you’re eating a plant which is helping the world.
E: Okay, so you’re saying-, I’m trying to figure out what your argument is-
R: I think it’s better to eat meat, more healthier to eat meat, then it is to be vegetarian. I think it’s better for the world to eat meat, then to be vegetarian.
E: It’s better for the world to eat meat because-
R: It feeds more people, well it doesn’t actually, no, that’s wrong. It’s just better for you, I think.
E: It’s-, so you think it’s healthier to eat meat?
R: Yeah.
E: So where’s that information from?
R: Um, just like-, my self seeing like-, I can’t picture a person being strong and like have healthy bones and like have a lot of energy by just eating plants. You need to have meat to get that meat in your body to get meat on your bones.
E: So have you ever met a vegetarian?
R: Yeah, they’re all skinny and lengthy…Don’t vegetarians have to take pills because they’re vegetarian and they’re not going to live? (Interview 2, 5/4/09)

In this example, Rick seems to be exhibiting “selective interpretation” in which Rick is interpreting elements from his own experience to attempt to re-affirm his consumer-materialist values, which he is unwilling to reconsider on this issue.

Not surprisingly, Rick claims that his beliefs have not been influenced by the class, nor have his environmentally-related behaviors changed as a result of the class. According to the environmental attitude and behavior surveys, Rick has actually decreased his pro-environmental attitude by 0.27 points and increased his ecological footprint by 3 points to 26.5. This substantial increase in his behavior score may be due to
a severe injury to his right arm at the end of the semester, which may have made it
difficult to maintain some environmentally-friendly behaviors.

Overall, Rick exemplifies a student whose negative interactions with class
structures, especially his relationship with the teacher, reinforced previous negative
experiences in school. Unfortunately, these interactions result in Rick’s unwillingness to
listen and learn, and the class ultimately has little impact on Rick, exemplifying the
importance of the student-teacher relationship. At those times when his identity is
disconfirmed, Rick uses several defense mechanisms that keep him from critically
reflecting on his own values and behaviors. Although there are a few topics discussed in
class which Rick relates to on a compassionate level, his largely combative stance
towards the class limited the influence on his environmental identity.

**Discussion and Implications**

The results presented above for the four students provide significant insight into
the process of change in these students’ environmental identity and associated behaviors
during the course of the semester. As we consider the impact that the course had upon the
students, it is important to reflect on the ways in which the findings agree with the model
presented in Figure 1, and ways in which the results add more depth to this model.
Regarding the environmental identity of the students, the findings show that students
entered the class at various stages of development of their environmental identity. For the
various students, different aspects of their family’s environmental commitment, their
nature experiences, and their experiences in school combined to influence their
environmental identity and associated behaviors. The students in this particular class
almost all recycled at the start of class due to a local town decision requiring recycling,
and most had spent some time during their youth in the outdoors, contributing to at least some level of environmental awareness.

Relating the results to Kempton and Holland’s (2003) stages of development of environmental identity, Greg and Rick were representative of students entering the class in the salience stage of environmental development, where they had some awareness of environmental issues, but incorporated few environmental behaviors into their lifestyle. C.P. and Kat were representative of students that began the class at a more advanced stage of environmental identity development called empowerment. At this level, both of these students were already carrying out environmental behaviors for environmental reasons.

As students participated in the Environmental Science course, the findings show that even those with a stronger environmental identity have this identity “competing” with many others. In Zavestoski’s (2003) study of deep ecologists, he found this to be the case even with very committed environmental activists. He found that “ecological identities ranked behind occupational, kinship, altruistic or compassionate, moral, and taste or interest identities” (p. 305).

The various aspects of identity that emerged as important during analysis of the results include the students’ environmental identity interacting with their consumer-materialist identity, social identity, and student identity. For example, consumer behavior is often learned from one’s family and cultural norms, and is taken on by students as their own consumer-materialist identity. This is often competing with one’s environmental identity as this aspect of one’s identity is strengthened. In the results, we witnessed both C.P. and Kat struggling as the culturally acceptable behavior of eating meat was
questioned by Mrs. P and the information presented in the course. The cultural influence upon both of these students was evident as neither of them had support from their families to address this issue at home. Additionally, these students both expressed feeling negatively about their consumer-materialist values after completing the ecological footprint, but were unsure of what they could do within their own living situation to change the behavior of themselves and their families. The influence of culture and family values should therefore not be overlooked by teachers as they present new information to students that may conflict with their values.

In addition, students’ prior experiences in school, and their roles in the class as well as within their family, contribute to their student and social identity, which may influence whether one is positioned in a way to be accepting of or rejecting the information encountered in class. For example, Rick’s student identity encompassing a negative attitude toward school had developed over years of previous experiences. In addition to the misalignment of his ideas regarding the appropriate role of the teacher and what he perceived to be her one-sided viewpoint, this made it extremely difficult for the teacher to have any impact on this student. This, in turn, affected Rick’s social identity, as he had become known as a difficult student and continued to act out this “performance role” in the Environmental Science class. Due to the significance of the interactions of other aspects of one’s identity with an individual’s environmental identity, it is necessary to expand the inner circle of Figure 1. In Figure 2, the amended version of Figure 1, consumer identity, social identity, and student identity have been added to emphasize that they are important factors in determining how students are influenced by the Environmental Science course.

185
Figure 2. This diagram portrays the process of change for students in the Environmental Science elective course. The box at left contains the elements contributing to the students' environmental identity that they bring to class. This identity, as well as the other identities of each student, interacts with the classroom structures and course content to determine a students' reaction to classroom activities. The other arrows represent the factors related to emotion, identity, openness to new information, and critical reflection, resulting from this interaction that help determine whether or not a students' environmental identity and associated behaviors are affected by the course.
In Figure 2, we also have the various aspects of students’ identities interacting with classroom structures, including social relationships and the course content. A combination of these factors is operating as the students express their desire for the teacher to be less one-sided and more open to student opinions. C.P., Kat, and Rick all state at some point during the semester that they would like to see more of a balanced presentation of the environmental issues presented in the class. Interestingly, all three of these students express negative emotions when they feel the teacher is failing to present multiple sides of the issues, which negatively affects their willingness to accept the teacher’s arguments. Greg, on the other hand, who has a very positive relationship with Mrs. P (who views him as a leader in the class) and is accepting of the information she presents, does not seem to notice the one-sided nature of Mrs. P’s presentation of some issues. Therefore, there seems to be a potential correlation between how students view the teacher’s presentation of the issues in the course (one-side or balanced) and their willingness to accept the teacher’s arguments. This connection requires more research in order to determine with greater accuracy the nature of this relationship.

Moving toward the left side of Figure 2, there are several factors that seem to be affecting if and how each student changes her environmental identity during the semester. In the results, it is evident that various elements of the students’ identities are being called into question, often for the first time. Many students experience negative emotions as part of a distress response when a major aspect of their lifestyle (i.e. meat-eating) is questioned. In order to diminish these negative emotions, students react with a number of defense responses, of which we have seen several examples in the vignettes of the student interviews. Common responses include blaming others or their situation when they feel
badly about their own behavior, referred to as “scapegoating the audience” by McCall and Simmons (1978). This was the case with both C.P. and Kat when they first did the ecological footprint. Another response observed was “selective interpretation” where a student gives their own interpretation to information they are hearing in class. There is an example of Rick responding this way, but this is a common mechanism used by other student interviewees as well to uphold their own beliefs. Another mechanism used is ignoring the new information that has been learned, which McCall and Simmons (1978) call “short-term credit.” Both Kat and Greg say they are able to do this in order to continue with their meat-eating habits even after gaining upsetting knowledge about the source of this meat. Finally, we see C.P. actually take on a new identity as he moves in the direction of becoming a vegetarian as a result of experiences in the class.

Along with these responses to negative feelings caused by disconfirmation of students’ consumer-materialist identity, most of the student interviewees experienced positive emotions or those of compassion as their environmental identity was affirmed or strengthened at some point during the class. This environmental identity affirmation led to four possible behavioral outcomes, which were demonstrated by the students described in the results above. C.P. demonstrated a deeper environmental behavior change that involved a shift of lifestyle and a rejection of a cultural norm (meat-eating, driving, etc). Kat’s changes involved simple behavior adjustments that did not involve a shift in lifestyle, but were significant nonetheless (reducing tap water, fewer showers, using scrap paper, etc). Greg is an example of a student that now understands the environmental reasons for doing a behavior he already did (turning off lights, television, recycling, etc) and therefore has gained a greater commitment to these activities. Although Rick had
aspects of his environmental identity affirmed at times, his other interactions in class limited the affect this affirmation had on his behavior. Since the results demonstrate the important link between emotion, identity affirmation and disconfirmation, and resulting change in identity and behavior, this association has been added to the original model in Figure 1. In Figure 2, we see that students’ emotional responses which are often directly connected to their identity affirmation and disconfirmation have been added as a major factor contributing to whether change in a student’s environmental identity and associated behaviors occurs.

Two other factors that seem to influence whether a student makes any significant changes in his/her environmental identity and pro-environmental behaviors are the openness of the student to learning and accepting new knowledge, and the student’s willingness to critically reflect upon this new knowledge. Jack Mezirow, one of the founders of transformative learning theory, defines critical reflection as “a process by which we attempt to justify our beliefs, either by rationally examining assumptions, often in response to intuitively becoming aware that something is wrong with the result of our thought, or challenging its validity through discourse with others of differing viewpoints and arriving at the best informed judgment” (cited in Taylor. 2001, p. 220). While students enter the class with some level of openness and experience with critical thinking, this level can be heightened or turned off almost completely as a result of interactions within the classroom. For example, when students were encouraged by the activities in the class to critically reflect on their environmentally-related behaviors, a student with strong critical thinking skills such as C.P. (and Kat to a lesser extent), who was always reflecting on the discussion in class and how this related to his own views, was more
likely to be self-reflective when aspects of his identity were disconfirmed. To the contrary, a student such as Rick, who was closed off to learning in this class due to his previous experiences in school and his interactions in this class, was not likely to seriously engage in the process of reflecting on his behaviors when his identity was disconfirmed. Greg, on the other hand, was very open and accepting of the information he learned in class, but his uncritical stance seemed to translate into his lack of critical reflection upon his own behaviors. Because of the significance of each student's openness to learning new information and willingness to think critically about his/her own beliefs and behaviors, these factors have been added to Figure 2 as well. Figure 2 demonstrates that a student's openness and willingness to reflect critically may be impacted by the student's experiences in the class, and is also connected to how a student responds when aspects of her identity are affirmed or disconfirmed, thereby playing a significant role in determining whether change occurs in a student's environmental identity and associated behaviors.

In terms of how a student's environmental identity may be impacted by the Environmental Science course, we must remember that for most students entering the class the salience of their environmental identity is quite low compared with the prominence of their other identities. As students gain knowledge of various environmental issues, awareness of human impacts on the environment, and participate in pro-environmental actions (e.g. the school recycling program) on a weekly basis, students are asked by this teacher to consider their own environmental beliefs and behaviors. As they struggle to define this aspect of their identity, for many students the salience increases as they realize the environmental reasons for behaviors they already did and
begin to take on small behavior changes. Students that come to this realization have entered into the *empowerment* phase of environmental identity development, as they gain an understanding of ways they can adjust their personal behavior to make a difference on an individual level. Greg was an example of a student that moved from the *salience* stage to the *empowerment* stage during the course, while Kat and C.P. both moved further into the *empowerment* stage as they were able to take on new pro-environmental behaviors. All three of these represented “substantial” changes in students’ environmental identity as their level of empowerment was significantly increased and resulted in behavioral change.

All of the behavioral changes expressed by students during the interviews would be classified as “cultural reform” types of changes in their behavior, as opposed to “civic action” which may be more expected of individuals in the third stage of environmental identity development, where they take on a more active role in the environmental movement in the public arena. It is not surprising that students’ behavior changes were of the “cultural reform” type because personal behavior was more emphasized in the class through activities like the ecological footprint, creating a list of all the items they own, class recycling, awareness of food production and the source of food, etc. The only “civic action” type activity in the class was a mock town meeting, where students’ took on a role in a fictitious development case involving local public lands. Future studies are needed to see if inclusion of more civic action type activities in the class brings about different types of changes in students’ pro-environmental behavior.

Several studies have shown that individuals need to be in a supportive environment for an identity to gain salience. However, because many social “others” do
not have a developed environmental identity, it can be very difficult for an environmental identity to be maintained (Zavestoski, 2003). For the student participants in this study, this is clearly the case as students leave the classroom and face a world of unsupportive others, often times members of their own families. This leads to the conclusion that if we view environmental identities as social identities that must be nurtured and affirmed through social interaction with others, then we must provide students with strategies and support for maintaining their environmental identity outside of the classroom. An example of this type of support is the encouragement Greg receives from Mrs. P when he shares with the class his commitment to recycling in Mr. K’s class when this teacher is not a supporter of the recycling program himself. As this example comes to the attention of the whole class, students are hearing from a “cool kid” upholding his environmental identity, which may serve to affirm their own environmental identity and encourage their willingness to make the extra effort to recycle as well. Having cogenerative dialogues, which are small group dialogues involving a few students and the teacher that meet on a regular basis, is another opportunity for students to feel supported as they struggle to define their own environmental identity.

The results from this study should indicate to teachers several important factors to consider as they work with their students to help them define their relationship with the environment. The findings highlight the significance of students’ emotional responses to activities in the class and indicate that these are related to aspects of the student’s identity being affirmed or disconfirmed. Therefore, as a teacher plans the curriculum for the Environmental Science course, it is important to consider whether the activity is likely to affirm or disconfirm the students’ identity, and provide the necessary support when a
students' identity is disconfirmed. Additionally, it is important to balance the class with activities that will evoke both positive and negative emotions in students, so that students will not be overwhelmed and feel a lack of empowerment as their environmental awareness increases. We saw from the responses of Kat and Greg that many students are willing to make small changes in their lifestyle to help the environment if they are given options and made aware of how they can help. Therefore, by providing opportunities in class for students to actively participate in a pro-environmental activity such as recycling, and informing students about changes they can make at home through an activity such as an ecological footprint, the teacher is also promoting a sense of self-efficacy in her students.

The findings also indicate that encouraging students to be open to new information learned in class through a more balanced presentation of the issues may be an effective teaching strategy. Students, such as Kat and Rick, were clearly turned off to listening to the teacher when they perceived that the teacher was one-sided and too biased. In presenting multiple sides of an issue, the teacher can also encourage students to be open to the other sides of the issue, help students to practice their argument assessment skills, and to critically reflect upon their own views and how they fit in with those being discussed. Giving students the opportunity to argue various sides of issues, such as during a town meeting or class debate, are also ways of encouraging critical thinking in students. The relation between student openness to new information, willingness to critically reflect upon this information, and the various aspects of identity needs to be further explored in future studies.
Conclusion

Results from this study clearly indicate that this Environmental Science course had a substantial influence on the development of the students’ environmental identity, as well as on many students’ environmentally-related behaviors. Further research needs to be conducted to determine whether other Environmental Science classes are having similar effects upon students from a variety of backgrounds. This research shows that students at different stages of development of their environmental identity can benefit from this type of course, especially in terms of improving the salience and empowerment aspects of this development. More research needs to be done to investigate whether other Environmental Science teachers are emphasizing civic action more than this particular teacher, in addition to determining how other environmental classes with more of a “science” focus, rather than an interdisciplinary focus on the issues, affect students’ environmental identity and behavior. Additionally, although this study provides important insights regarding the factors of emotion, identity, critical reflection, and openness to new information, that may be affecting whether change in a students’ environmental identity and associated behaviors are likely to occur, further studies need to be conducted exploring the relationship among these factors in more depth.

Importantly, however, this study’s findings demonstrate that the Environmental Science course at the high school level is beneficial in helping students’ develop an understanding of their relationship with the environment and promoting environmental action through student empowerment.
CHAPTER 4

A SOCIOCULTURAL ANALYSIS OF ACTIVITY IN AN ENVIRONMENTAL SCIENCE COURSE

The Environmental Science course continues to gain traction in the high school curriculum; however, there has been little research investigating how various activities are impacting students’ environmental learning. This ethnographic study at a public high school in the Northeastern United States uses a sociocultural approach to explore how students’ environmental identities, their interactions with the course content, as well as their social interactions influence the effectiveness of various activities in the Environmental Science classroom. The participants in this study are an Environmental Science teacher and the 10-12th grade students in her semester-long elective, "Environmental Science." The researcher collected data for a period of six months during the spring semester of 2009, attending class on a daily basis. Data was collected through participant observation, videotaping, interviews, cogenerative dialogues, and an activity survey. The results of this study provide new information for educators working with students to help them define their relationship with the environment by illuminating the elements of various activities that are effective for individual students, as well as the factors that may be prohibitive. Findings therefore provide insight for science teachers designing and incorporating environmental activities into the high school curriculum.
Introduction

During the past decade, as environmental science courses have gained prominence in the high school curriculum, many more students are participating in this type of course as either part of the core curriculum, an elective, or at the AP level (Edelson, 2007). However, few studies have considered from a curricular standpoint how various activities are affecting students in terms of their relationship with the environment (Zavestoski, 2003). For example, how are students’ environmental identities impacted by their experiences in an Environmental Science course? How do students’ interactions with the course content affect their learning? How about peer-peer relationships? From a sociocultural perspective, these are all important questions to begin to address in the assessment of students’ learning about the environment.

To begin to answer these questions, an Environmental Science classroom in a high school was chosen for the setting of this research. While most studies at the secondary level have been quantitative surveys evaluating the relationship between students’ environmental knowledge, attitudes and behaviors by analyzing data at the level of the classroom or school (Kuhlemeier, Bergh, & Lagerweij, 1999; Meinhold & Malkus, 2005), this study employs an ethnographic, sociocultural approach in order to build an in-depth picture of how students are experiencing learning activities in a single Environmental Science course.

By concentrating on student reactions to seven lesson activities in the Environmental Science class, the study examines student perceptions of their experiences, highlighting issues of student identity, course content, and social relationships. The teacher’s goals and objectives for each of the activities were also
investigated in order to compare teacher intent to actual student outcomes. In this way, the findings further clarify the affordances and challenges resulting from student interaction with the material and each other.

This study attempts to further our understanding of student learning in the Environmental Science classroom by investigating the following questions (which are adapted from topical questions #2, 3, and 4 presented in Chapter 2):

1. What are the teachers’ goals and intentions for inclusion of various activities within the Environmental Science curriculum?

2. In what ways, if any, do various activities in the Environmental Science classroom affect students’ environmental identity?

3. How do the sources of information and students’ interaction with the content of the course influence their environmental learning?

4. How do classroom structures, including the social interactions and power dynamics within the classroom, influence the learning of students as they participate in various activities in the Environmental Science classroom?

**Literature Review**

The broad goal of widespread environmental literacy, which has been called for since the Belgrade Charter was established at the International Workshop on Environmental Education in 1975 (UNESCO, 2007), has set the foundation for research in the field. Here the goal of environmental education was defined as follows:

> to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current environmental problems and the prevention of new ones.” (The Belgrade Charter: A Global Framework for Environmental Education, 1975)

Since the establishment of this goal, research aimed at evaluating environmental education programs in both the formal and non-formal educational sectors have been conducted measuring various aspects of environmental knowledge, skills, attitudes, and
behaviors. Various survey instruments have been developed to measure these constructs (Bogner & Wiseman, 1999; Dunlap et al., 2000; Manoli & Johnson, 2007), but few studies have been focused on the activities or elements of the curriculum that are having a pro-environmental affect on the students. Rather, the majority of studies focus on establishing the relationships between the constructs of knowledge, attitude, and behavior (Hwang et al., 2000; Kuhlemeier et al., 1999) or investigating change over time for an entire program or course (Culen & Volk, 2000; Hsu, 2004).

In this latter category, two notable studies examine change in environmental attitudes and behaviors as students participated in a formal education program (Culen & Volk, 2000; Hsu, 2004). Rather than investigating specific activities, both of these studies analyze a teaching approach called the “Issue investigation-evaluation and action skills training model” by giving pre- and post-tests to experimental and control groups of students. Culen and Volk (2000) study how this program is implemented with 7th and 8th graders, while Hsu (2004) evaluates this program as it is applied in a university level Environmental Science course in Taiwan. While findings show positive increases in responsible environmental behavior, environmental attitudes, and intention to act, the exclusively quantitative data provides little information as to students’ reactions to specific activities or experiences encountered during the course.

Other studies, such as that of Meinhold and Malkus (2005) and Kuhlemeier et al. (1999), which have been focused on the secondary school population, were aimed primarily at determining the relationships between the constructs of environmental knowledge, attitudes, and behaviors. However, this research often targets a large population with little commonality in the curriculum of the student participants. For
example, Meinhold and Malkus (2005) study a population of adolescents from high-achieving high schools in three large US cities and Kuhlemeier et al. (1999) target high school students throughout the Netherlands. Neither attempts to make any correlation with the particular curriculum or coursework to which these students have been exposed, providing little information regarding what factors accounted for the variance in the study outcomes for individual students.

Additionally, many curricular guides and guidelines for environmental education have been developed, but formal studies looking at the enactment of these curricula and how they are impacting students are almost completely lacking. For example, environmental educators often adapt activities from the Project Wet, Wild, and Learning Tree series, refer to the NAAEE (North American Association for Environmental Education) Excellence in Environmental Education Guidelines for Learning (Pre K-12), conduct outdoor investigations with students, or access the numerous ecological footprint sites on-line for students to complete. However, few data have been collected to document how these various activities are impacting students (Zelezny, 1999). In the current study, therefore, special focus is placed on particular students within the Environmental Science classroom in order to explore how students are experiencing various activities.

Another set of recent studies has been focused on investigating the role of environmental identity in the development of individuals’ relationship with the environment. The concept of environmental identity is defined by Clayton (2003) as “a sense of connection to some part of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the ways in which we perceive and
act towards the world; a belief that the environment is important to us and an important part of who we are” (p. 46). Recent research has documented the importance of environmental identity among adult environmental activists or professionals (Chawla, 1998; Chawla, 1999; Kempton & Holland, 2003; Zavestoski, 2003). For example, Zavestoski (2003) conducted a qualitative study with participants at a Deep Ecology retreat. Through participant observation, interviews, and identity surveys, he learns of the difficulties many of these committed environmental activists encounter in maintaining their environmental identities in a social world filled with “social actors” with less developed environmental identities. The findings show that many of the activists sought ways of nurturing and sustaining their environmental identities through their career choices, spiritual affiliations, and social networks (Zavestoski, 2003). Similarly, Kempton and Holland (2003) conducted 159 “identity interviews” with members of representative types of environmental organizations, where they investigated each participant’s history of involvement with the environmental movement, providing useful information regarding the process of environmental identity development, which is explicated in the Environmental Identity section below. Although these studies provide significant findings regarding environmental identity, Holmes (2003) recommends that we expand this range of research participants to incorporate a wider range of socioeconomic and cultural diversity, rather than focusing specifically on environmentalist participants.

The adolescent population is a likely target for expansion of research regarding environmental identity. It has long been suggested by Harold Searles (1960), that especially during adolescence, the individual is dealing with an inner struggle in trying to define her relationship with the environment. More recently, Walsh-Daneshmandi and
MacLachlan (2006), in their study investigating the validity and reliability of an environmental knowledge and attitudes survey among a population of Irish adolescents age 15-17, have found that “motivating forces for environmental consciousness may be different in the adolescent from those salient for other age groups” (p. 22). Despite the suggestion that aspects of adolescents' identity may be influenced by their views of the environment, there has been little research focused on the adolescent population regarding environmental identity (Zavestoski, 2003). By focusing on adolescents in a public high school that come from a variety of environmental backgrounds, the current study begins to address this void in the current research.

**Theoretical Framework**

**Activity as the Unit of Analysis**

The above critique of the empirical studies in the Environmental Education field demonstrates that many studies have used a quantitative approach focused on a macro level of analysis that lacks attention to social or cultural context. In this research study, in an attempt to provide an additional perspective on learning in environmental education settings, a shift has been made to an approach informed by sociocultural learning theory. This theory posits that learning is embedded in social activities that occur as a child interacts with people, objects, and events in her environment, and suggests that we must examine the external social world of an individual in order to understand her development (Kublin, Wetherby, Crais, & Prizant, 1989). The foundations of sociocultural theory are built upon the ideas of Lev Vygotsky and Barbara Rogoff, whose ideas are only briefly explored here (Rogoff, 1990; Vygotsky, 1978). Vygotsky views learning and development as a process of *internalization*, where the individual is
interacting in social settings and internalizing what she is learning from others through this interaction (Minick, 1987). Rogoff takes Vygotsky’s ideas to another level by suggesting the non-existence of the internal/external dichotomy of the individual and social interaction. She criticizes the term “internalization” because it suggests a separation of the individual (internal) from her social context (external), and assumes the “acquisition” of concepts which can be stored in the mind. Instead, Rogoff (1990) prefers the term participatory appropriation, which she describes as “the process by which individuals transform their understanding of and responsibility for activities through their own participation” (p. 150). Appropriation is focused on the active changes, which could be either in the rational or non-rational realm, that occur in an individual while she is participating in an activity, preparing her for involvement in other similar events in the future (Rogoff, 1990).

Another significant contribution of Vygotsky to the field of learning theory was shifting the unit of analysis from the individual to activity (Minick, 1987; Vygotsky, 1978). Rogoff (1990) suggests that this shift has allowed for a new focus on learners as active participants in socially constituted practices. Interestingly, years earlier, John Dewey also provides a similar view of activity, which he calls “educative teaching,” during which a young person participates in the social activities of her group and shares in the thoughts and emotions surrounding these activities. To quote Dewey:

A being connected with other beings cannot perform his own activities without taking the activities of others into account. For they are the indispensable conditions of the realization of his tendencies. When he moves he stirs them and reciprocally. We might as well try to imagine a business man doing business, buying and selling, all by himself, as to conceive it possible to define the activities of an individual in terms of his isolated actions. (Dewey, 1916, p. 14)
Dewey, as a pragmatist, sees human action as driven by social conditions and the problems, questions, and realities created by groups of people. He therefore shares the conviction with Rogoff and Vygotsky that activity is the focal point for learning with the individual dependent upon the sociocultural context of the learning situation.

In this study, the sociocultural framework established by Vygotsky and Rogoff is utilized, placing activity at the center of all interaction as the unit of analysis. Rather than focusing upon the individuals in the class as isolated entities, this means that, as suggested by Tobin (2007), I will view “all individuals as dialectically interconnected with the collective, and each presupposes the other (i.e., individual/collective). This implies that no individual can act independently of the collective and individual actions become material resources that structure collective agency” (Tobin, 2007, p. 7). This study investigates the process of learning among “interconnected” individuals as they participate in classroom activities. By focusing on activity, this allows the researcher to explore interactions on multiple levels, including those layers of interaction which are visible through observation, and also those layers involving participants’ sociocultural background and influences that need to be explored more deeply.

Classroom Structure and Sewell’s Cultural Sociology

A view of culture consistent with sociocultural learning theory is utilized in the current research to better understand the context of the activities in the classroom. Culture is defined in the field of cultural sociology (Sewell, 1999) “as a weakly bound system of schema and practices that interact in a dialectical relation with each other, material resources, and agency (the power to act and appropriate resources to meet one’s goals)” (Lavan, 2004, p. 62). The structures operating in a given setting represent a
combination of the schema, or ideologies of the participants, as well as the material and symbolic resources being employed within that setting, and in this case during classroom activities. These structural factors are interconnected with agency in determining what practices are enacted (Martin, 2004). These practices can be said to operate within fields (structured places where participants enact culture), such as an Environmental Science classroom, whose boundaries are “both weak and porous” allowing cultures from other fields, such as home, to be enacted within the classroom (Loman, 2005).

The concept of agency is important as it relates to the concept of self-efficacy, which is prominent in the environmental education literature, and is defined as “the confidence that individuals have in their ability to plan and execute a course of action and to accomplish a task or solve a problem” (Meinhold & Malkus, 2005). The relation of self-efficacy to environmental action makes sense intuitively, and several studies have shown this correlation (Hwang et al, 2000; Meinhold & Malkus, 2005). In terms of its relation to sociocultural experiences, it could be hypothesized that if a person feels empowered during these activities (has a sense of agency), then this would lead to feelings of self-efficacy, whereas if she feels helpless, out of control, or taken advantage of (lacking agency), then this would lead to a lack of self-efficacy.

The development of this sense of empowerment is likely influenced by the power dynamics of the classroom. For example, describing the dialectical relationship between structures and agency, Loman (2005) states that “the dispositions to act, as a result of a person’s habitus depend on the capital the individual holds in the field of the classroom” (p. 174). In other words, if a student feels that she has a voice in the classroom, then this may translate into the student being more likely to take action regarding other issues that...
she deems important. In an article by Bayne (2008), she discusses the importance of both individual agency and collective agency in creating a supportive classroom culture that moves towards meeting its goals. As such, this is an important concept to consider within an Environmental Science classroom where both individual and collective agency may play a role in how students feel about their ability to “make a difference.” If students feel that they can access the resources they need to be heard and have a voice, then it would follow that they would be more likely to partake in pro-environmental action. The concepts of agency and self-efficacy are useful in interpreting the teacher’s goals in this study related to student empowerment.

Within the context of this study, of particular interest are classroom structures related to the idea of agency including both peer-peer interactions and teacher-student interactions. Additionally, the ways in which structures support or discourage both the social and environmental identities of the students in the class, as well as student interactions with the environmental content of the course, are given significant attention. Each of these structures will be explored through the lens of various activities that occurred during the semester in the Environmental Science course.

**Environmental Identity**

According to Clayton (2003), a connection has been shown to exist between our social interactions, our relationship with nature, and our identity. She states, “An understanding of oneself in a natural environment cannot be fully separated from the social meanings given to nature and environmental issues, which will vary according to culture, world view, and religion” (p. 53). Therefore, Clayton (2003) is suggesting that environmental identity is inseparable from the social and cultural aspects of our lives. In
viewing environmental identity as a social phenomenon, Cronon (1996) adds that in the
digital age, we must consider what young people are viewing on the television, internet,
and the media regarding environmental destruction if we want to fully understand the
genesis of an environmental consciousness.

There are others, however, that turn to more individual experience, thought, and
struggle as the means of establishing an environmental identity. For example, Holmes
(2003) describes how it is the “actions, concepts, meanings, and feelings” experienced in
a specific place that allow “it to serve as a basis for or reflection of individual identity”
and then adds that “perhaps place and self-hood are mutually codefining” (p. 30). Harold
Searles (1960) claims that especially during adolescence, the individual is dealing with a

sense of inner conflict concerning his awareness that he is part of Nature and yet
apart from all the rest of nonhuman Nature; and the two great ingredients of this
inner conflict—man’s yearning to become wholly at one with his non-human
environment, and his contrasting anxiety lest he become so and thus lose his own
unique humanness. (p. 114, emphasis in original)

Here Searles is essentially stating that we can only truly come to know ourselves through
struggling with our relation to Nature and non-human others. Others have found that
environmental identities can emerge from an intersection of moral and social
responsibility (Kals & Ittner, 2003; Marcia, 1980; Zavestoski, 2003). In this study,
environmental identity is viewed as being influenced by both internal characteristics and
personal experiences, as well as social interactions with others.

One of the most thoroughly explicated theories of the development of
environmental identity comes from Kempton and Holland (2003). According to Kempton
and Holland (2003), there are three interrelated aspects of environmental identity
formation. One aspect of development is a new awareness of environmental issues,
whereby an understanding of environmental threats becomes more salient. In their study of environmental activists, interviewees often describe this stage of increased salience by using the word “aware” or “waking up.” This could be the result of direct experience with local environmental destruction or a connection with a larger environmental issue. As individuals move through different aspects of development of their environmental identity, Kempton and Holland refer to these identity processes as “reformulations.” The second type of reformulation occurs when an individual gains a sense of empowerment, during which she acquires a sense of agency, or a belief that one can act effectively either alone or as a member of a group. Kempton and Holland (2003) found that those that identify themselves as environmentalists have acquired this sense of empowerment by taking on a role where action was a necessary part of one’s environmental involvement. In some cases, taking part in an environmental event or activity brought about an increase in salience or awareness of environmental issues and therefore, an adjustment in one’s environmental beliefs and values, rather than the other way around. A third type of reformulation occurs as one becomes more active in the environmental movement by carrying out actions and engaging in environmental practices. At this stage, an individual often becomes more knowledgeable about how to be an effective activist through the mentorship of more experienced others with common values.

Additionally, a helpful distinction that is discussed by Kempton and Holland (2003) is the differentiation between two categories of environmental action, which they call “civic action” and “cultural reform.” The first of these includes actions aimed at reforming corporate behavior or actions of the government, including membership in environmental groups, petitioning local government, or grassroots organizing. In contrast,
cultural reform often occurs as a direct response to consumer culture. Environmentalists enacting this type of reform attempt to be role models of environmentally-friendly practices in their own lives, and may also include efforts to influence others to reform their own practices as well. In the current study, this distinction is useful in determining which types of behaviors are encouraged by the teacher through the different activities and which action-related skills are introduced to the students during the Environmental Science course.

Identity Theory of Emotion

Several studies in the field of environmental education have found that emotion may play a key role in determining an individual’s relationship with the environment (Horwitz, 1996; Kals et al., 1999). Therefore, the emotional responses of students to activities in the classroom are carefully analyzed in this study. The focus on identity described above is directly connected with students’ emotions through a framework from the field of sociology known as the identity theory of emotion. This theory of emotion is one of the *symbolic interactionist* theories which emphasize identity as a prominent regulator of emotion and associated behavior. The identity theory of emotion becomes useful in interpreting the emotions individuals experience as their self-conception is affirmed or disconfirmed during the course of interaction (Turner & Stets, 2005).

Because this study examines the environmental identities of the participants within a social context, symbolic interactionist theories, specifically those of Stryker (2004) and McCall and Simmons (1978), are utilized.

conceptualizes the role of emotions in the identity process by considering an individual’s emotional response to others’ reactions to one’s “role performance” of a given identity. When others affirm one’s identity, positive emotions will be experienced, tending to raise the salience of that particular identity. The higher the identity is ranked for an individual, the more acute will be their emotional response. In contrast, when one’s identity is disconfirmed, negative emotions will be experienced, forcing the individual to reevaluate commitments to an identity. According to Stryker’s theory, a person will tend to develop an identity that is affirmed, while lowering an identity in the salience hierarchy that is not meeting the normative expectations of a social network.

Further application of identity theory by Hitlin (2003) utilizes the concept of values as a connection between identity and emotion. Hitlin (2003) suggests a role for values in forming the core self, which are then applied through various situational identities. Similarly, Dittmar et al. (2007) states that each individual’s underlying value system acts as a guide for specific motives and behaviors. Hitlin refers to the conceptualization of values by Schwartz (1994) as "desirable transsituational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity" (cited in Hitlin, 2003, p. 119). Additionally, Schwartz (1992) and Schartz and Bilsky (1987) state that values meet five criteria: “(1) they are concepts or beliefs, (2) they pertain to desirable end states or behaviors, (3) they transcend specific situations, (4) they guide selection or evaluation of behavior and events, and (5) they are ordered by relative importance (cited in Hitlin, 2003, p. 119). According to Hitlin (2003), these values are enacted situationally through the development of various role or group identities. Notably, Hitlin (2003) also states that “the behaviors we enact as a result of our
identities can cause us to reflect on our values and, over time, to find different values most compelling. When this happens, we experience shifts in our personal identity, our sense of ‘who we are’” (p. 122). In this statement Hitlin is connecting identity theory with values and behavior through the process of critical reflection.

In the current study, the participants’ values regarding the environment are explored as they are enacted through an individual’s situational identities. In addition to environmental identity, discussed above, central to current consumer culture is another aspect of identity referred to in this study as consumer-materialist identity. This aspect of identity, according to Richins (2004), involves a materialistic value endorsement which can be described as the significance an individual assigns “to the ownership and acquisition of material goods in achieving major life goals” (p. 210). At the extreme, a person with highly materialistic values considers acquiring material goods as an important life goal and an indicator of success and self-definition (Richins, 2004).

Several recent studies have found that current consumer culture is characterized by a growing materialistic value orientation characterized by the pursuit of wealth and material possessions in order to gain image, status, and happiness (Dittmar, 2004a; Kasser & Kanner, 2004; Richins, 2004). As this study explores students’ identity, their environmental and materialistic values, perhaps often at odds with each other, are brought into focus as the activities in the class are aimed at helping students to reflect upon these values. As students’ environmental and materialistic values are affirmed or disconfirmed as a result of the activities in the Environmental Science course, this research seeks to discover in what way this may affect change in student’s environmental or consumer-materialist identity.
McCall and Simmons (1978) developed a similar identity theory to that of Stryker with the important addition of possible results when a person perceives a discrepancy between their own identity and situational or cultural expectations. These possibilities include (1) "short-term credit" where a particular episode of nonsupport for an identity is essentially ignored as a one-time event; (2) "selective perception" so that elements of a situation are given selective attention thereby affirming one's identity; (3) "selective interpretation" in which elements are accurately perceived, but interpreted allowing for identity affirmation; (4) withdraw from the interaction or situation that is disconfirming the identity; (5) switch to a new identity that is more easily confirmed, and (6) "scapegoat the audience" faulting others for the disconfirmation process. These responses to identity disconfirmation are used within the study context to characterize students' responses when their values, as fundamental aspects of their identity, are challenged during the Environmental Science class. This study explores which values are questioned through classroom activities and, most importantly, how and why these students come to either appropriate these environmentally-related values, ignore them, or explicitly reject them.

This particular set of theories has been chosen as a framework for this study because of the central role of identity for adolescents, as discussed previously. Throughout the Environmental Science course, various aspects of the students' environmental and consumer-materialist identity come into question on a daily basis. This study seeks to document how various activities cause students to reflect upon fundamental values regarding how they view their own and society's relationship with the environment, in addition to how students respond to these activities within the social context of the Environmental Science classroom.
Methodology

Setting and Participants

This study was conducted at a public high school in the Northeast, chosen based upon inclusion of an Environmental Science elective course in the school’s schedule, teachers’ willingness to participate, a diverse socioeconomic student population, and proximity to the research university for accessibility purposes. The school is located in a suburban neighborhood, but is attended by students from rural areas as far as an hour and a half away. The high school serves 1700 students with 23% eligible for free or reduced lunch. In 2006, the school had an 80% graduation rate, with 38.1% of students going on to four year colleges or universities, and in 2007, 101 students dropped out of school, representing 6% of the student population (http://www.city-data.com).

The participants in this study were 10-12th grade high school students (N = 17) in an Environmental Science elective course, as well as their teacher, referred to in this study as Mrs. P. The class was considered the lower level of two Environmental Science classes offered at the school, and the majority of students chose to take the course because it was thought to be an “easy” alternative to chemistry. Students had varying levels of participation in the study on a voluntary basis, including participation in the class, surveys, interviews, and/or cogenerative dialogues. Eight students and the teacher were interviewed three times over the course of the semester, and two students were interviewed twice. Nine students in various groupings participated in cogenerative dialogues, with some overlap with the group of interviewees. All students completed a survey at the end of the course asking them to rank the three most influential activities for them from a list of twenty-four activities they had participated in during the semester.
Students that were interviewed were asked in their final interview to elaborate on why the activities they chose were influential.

**Data Collection**

The ethnographic methodology selected for this study allows for exploration of the sociocultural elements that are influencing students as they participate in the activities of the Environmental Science classroom. Rather than quantitatively evaluating the effects of various activities, the research methods used in this study are aimed at organically discovering the influential factors affecting students' environmental learning. This research is therefore highlighting powerful experiences for the students in this specific Environmental Science class, and future research will be needed to generalize these findings to a broader population.

The research questions are explored through a subset of the following qualitative research strategies including: participant observation, videotaping, formal interviews, and cogenerative dialogues. The first layer of data collection, which can be characterized as ethnographic description, includes both participant observation and videotaping. The researcher attended class on a daily basis throughout the semester, allowing the researcher to observe the enacted curriculum. Field notes were kept daily in a field journal, including both reflexive and reflective sections (Emerson, Fretz, & Shaw, 1995). Observations focused on relationships and interactions among participants, both peer-peer interactions and student-teacher interactions, as they participated in classroom activities. Additionally, monitoring students' reactions to teaching strategies provided insights that were explored at a deeper level through the other research methods. The class was videotaped approximately once per week, specifically during interactive
activities when there was discussion between teacher and students. The videos provide a record of classroom activities that serve to augment field notes, and were used to prompt discussion during interviews and cogenerative dialogues.

A second layer of data was collected through formal interviews and cogenerative dialogues. A diverse sampling of ten students and the teacher were interviewed during a series of three interviews at the beginning, middle, and end of the semester. Each interview ranged from 30 minutes to an hour in length, and all interviews were audio-taped for later transcription and analysis. The teacher’s second and third interviews were approximately 90-100 minutes in length. The first interview with the students focused on participants’ environmental background, initial impressions of the course, and students’ environmental beliefs and behaviors when they entered the class. The second interview focused on students’ reactions to activities in class and peer-peer and teacher-student interactions. The questions during the third interview explored how students’ environmental beliefs and behaviors changed (or did not change) during the semester, which activities students’ found to be most influential, and what the affordances and obstacles were to change occurring. The teacher interviews focused on the teacher’s environmental background and beliefs and goals for the course (Interview 1), teacher’s assessment of how various activities were affecting students (Interview 2), and whether the teacher’s goals for the course had been met, and what the teacher viewed as the obstacles and affordances to accomplishing these goals (Interview 3).

Nine students, eight of whom were also interviewed, participated in cogenerative dialogues. Cogenerative dialogues, which are group discussions amongst stakeholders (e.g., teachers, several students, and administrators), “afford the examination of shared
experiences within a field—a physical and temporal place where individuals interact with each other—in order to co-create new culture and/or amend that culture which already exists, as a means to improve the quality and efficacy of teaching and learning” (Bayne, 2008). The dialogue groups of three students, myself, and the teacher met approximately once per week, every other week during the semester. The purpose of the dialogues were twofold in this study, serving both as a research tool for the researcher to gain insight into the reactions of students to various classroom structures and activities, as well as a method of improving the teaching and learning in the classroom by providing a setting where students and the teacher could openly discuss what was working and not working in the classroom and make suggestions to better their experiences in the classroom.

In addition to these qualitative methodologies, a survey was given to students at the end of the semester in order to collect data on student perceptions of the most influential activities they experienced in the class. Three students and the teacher helped create the list of twenty-four significant activities that the class participated in during the semester. The survey asked students to rank the three experiences that had influenced them the most with a “1”, “2”, or “3.” For each of the activities discussed in the results, the overall class ranking of the activity is reported. Additionally, the survey was used during students’ third interview to prompt discussion about why students thought the activities they had ranked were influential. Vignettes from several of these responses are included in the study results.

Data Analysis

In order to document students’ reactions to various activities that occurred during the semester, several techniques for analysis were used to ensure the rigor of qualitative
research, including multiple data sources, multiple levels of analysis, code checking with other qualified researchers, as well as member checks with the teacher and several of the student participants in the study (Creswell, 2003; Guba & Lincoln, 1989). Analysis of the data occurred in several stages, beginning with analysis of the student and teacher interview data using NVivo 8 software. Open coding was used at first to develop categories of activities that were discussed during the interviews. These categories included such activities as: documentaries, mock town meeting, class debate regarding the Alaskan National Wildlife Refuge (ANWR), etc. Next, “focused coding” (Charmaz, 2006) was used to develop themes within the activity categories. The codes for this segment of the analysis were generated from Gee’s An Introduction to Discourse Analysis: Theory and Method (2005). Specific questions under Gee’s categories of Building identities, Building relationships, Building politics (the distribution of social woods), Building connections, Building significance for sign systems and knowledge (p. 111-112) were deemed critical based on the theoretical framework of the study.

Examples of these questions, which were used as a guiding framework for coding, include: (1) “What identities (roles, positions), with their concomitant personal, social, and cultural knowledge and beliefs (cognition), feelings (affect), and values, seem to be relevant to, taken for granted in, or under construction in the situation?” (2) “What sorts of social relationships seem to be relevant to, taken for granted in, or under construction in the situation?” (3) “What social goods (e.g. status, power) are relevant (and irrelevant) in this situation?” and (4) “What systems of knowledge and ways of knowing are relevant (or irrelevant) in the situation?” The major themes that emerged from this analysis included the aim/purpose of the activity from the teacher’s perspective; the effect of the
activity on students' environmental and consumer-materialist identity; student interaction with the content for each activity; and social interactions that made the activity successful or compromised. Upon further analysis, the theme of student identity was subdivided into subthemes of identity affirmation and identity disconfirmation. The theme of student interaction with the content was subdivided into subthemes of a one-sided vs. balanced perspective, connection with students' lives, source of the content, and learning style. The theme of social interactions was subdivided into the subthemes of positive and negative student interactions, in addition to self-esteem concerns. The themes and subthemes were coded for accuracy by a fellow graduate student in the education department to ensure reliability of the coding procedure. There was a 98% overlap in the distribution of codes, and the final 2% were discussed and negotiated.

Third, the researcher watched the videotapes of the cogenerative dialogues during a meso-analysis at regular speed, while recording a chronology of topics being discussed. Segments that served to substantiate or contrast with findings in the interview data were noted. During a subsequent micro-analysis, these vignettes were transcribed verbatim, and coded according to the emergent themes and subthemes described above. No entirely new themes emerged; however, several of the themes were augmented with vignettes from the cogenerative dialogues. Additionally, field notes and classroom videotape were reviewed to ensure agreement between data sources.

Finally, in order to analyze the activity, student rankings were translated into scores where a ranking of “1” received 3 points, a ranking of “2” received 2 points, and a ranking of “3” received 1 point. This means that the higher the score for the activity, the
more influential students perceived it to be. Table 2 shows the scores for the activities which are discussed in the results section below.

**Results**

**The Activities**

Seven activities included in the curriculum of the Environmental Science course are described below, along with the teacher’s goals in including each activity in the course. The teacher’s goals are presented in order to provide context regarding the teacher’s intentions and a basis for discussion, rather than acting as a means of comparison about which particular goals were met or not met by each activity. A further discussion of the teacher’s goals for the course and students responses to these goals as they were enacted in the class is the focus of Chapter 5.

The seven activities that are presented in this paper were chosen because they were discussed thoroughly by students during interviews and cogenerative dialogues, often in response to questions about which activities they felt were influential and in what way they were impactiful. The order of the activities is presented in approximately the chronological order that they occurred during the semester with the exception of the field trip to the local landfill. This field trip occurred later in the semester, but is included after the ecological footprint/list of everything they owned activity because of its related theme around consumption. Other activities such as the films, the class discussion, and the days spent outdoors occurred at multiple points over the course of the semester. Table 1 is a summary of each of the seven activities, the teacher’s goals for the activity, and a brief description of the activity.
Table 2 shows the students’ ranking of the activities as most influential. Please note that some activities other than the seven main activities described below are listed in Table 2. These other activities are discussed at different points in the findings as well.

Table 2
Summary of the Seven Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Goals</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological Footprint/List of Everything They Own</td>
<td>Awareness of Consumerism</td>
<td>Students individually calculated their ecological footprint using an on-line website</td>
</tr>
<tr>
<td>Field Trip to the Local Landfill</td>
<td>Awareness of Linear Waste Streams</td>
<td>Students each attempted to list all the items that they own</td>
</tr>
<tr>
<td>Town Meeting</td>
<td>Sense of Place, Citizenship, and Empowerment</td>
<td>The class took a two hour guided tour of the local landfill focused on current landfill projects and the recycling program</td>
</tr>
<tr>
<td>PETA video and other documentaries</td>
<td>Raising Awareness and Evoking Compassion</td>
<td>The teacher showed several videos during the semester involving issues of population growth, deforestation, the agricultural industry, and the Exxon-Valdez oil spill</td>
</tr>
<tr>
<td>Alaska National Wildlife Refuge Debate</td>
<td>Understanding Both Sides of an Issue</td>
<td>After reviewing fact sheets representing both sides of the drilling debate, students were assigned to either the pro- or anti-drilling team, and engaged in a statement and response debate</td>
</tr>
<tr>
<td>Class Discussion/ Socratic Dialogue</td>
<td>Getting Students to Think</td>
<td>The teacher’s “default” teaching strategy involving the whole class in an open discussion on a variety of environmental topics</td>
</tr>
<tr>
<td>Taking Students Outdoors</td>
<td>Learning and Connecting with Nature</td>
<td>The class spent two days outdoors, the first involving a tree-coring demonstration, and the second a more informal hike through the woods adjacent to the school.</td>
</tr>
</tbody>
</table>

Table 3
Students’ Ranking of Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological Footprint/List of Everything Owned</td>
<td>2</td>
</tr>
<tr>
<td>Tree Coring</td>
<td>4</td>
</tr>
<tr>
<td>Town Meeting</td>
<td>9</td>
</tr>
<tr>
<td>Recycling</td>
<td>9</td>
</tr>
<tr>
<td>Field Trip to the Landfill</td>
<td>11</td>
</tr>
<tr>
<td>PETA Documentary</td>
<td>12</td>
</tr>
<tr>
<td>Other Documentaries Combined</td>
<td>16</td>
</tr>
</tbody>
</table>
Following the activity description and the teacher’s goals for each activity are the findings regarding how the activities affected students’ environmental identity, students’ interactions with the course content, and the impact of social interactions on the effectiveness of the activities.

Ecological Footprint/List of Everything They Own. *Aim/Purpose: Awareness of Consumerism.* During the first half of the semester, students completed an on-line ecological footprint during class, as well as a homework assignment to create a list of everything they own. During the first interview (2/4/09), Mrs. P explains her main goal for these exercises. Discussing her students, she states:

> Just like any American student, the things that are most influencing them are media things and the push to consume, and so, they do that, and that’s the most important thing to them...And consumption is, for me, the bottom line of the thing we need to address, how you consume and what you consume, and how political a dollar is, how much weight that throws around in the world...So basically, I think that because many of these kids live in trailers and come from low income and working class families, they want to get as much stuff as they can possibly get; it never dawns on anybody that there might be a down side to that...And people who are struggling to make it, and struggling to be taken seriously in this society, that’s the way they get there, they climb the ladder of consumption.

This vignette shows Mrs. P’s passion and commitment to helping her students see that there is a negative side of consumption of which they may not be aware. She wants to raise this awareness in the hope that students’ will question their underlying beliefs about success in American society. With the most influential activity rated a 16, these two activities combined received only 2 points, indicating that students’ did not perceive these activities to be among the most influential. However, at least four students mentioned these experiences and reactions to them during their interviews, which is why they are discussed in the findings.
Field Trip to the Local Landfill. *Aim/Purpose: Opening Students’ Eyes to Linear Waste Streams.* The local landfill is a ten minute bus ride from the high school, and Mrs. P arranged for students to spend the morning taking a tour of the landfill, which is also the recycling center for the town. In the following vignette, Mrs. P describes what she hopes students will learn from their visit to the landfill:

I’m hoping that by having the discussion for a couple of days about trash, and have them go home and look at their own trash, look at the stuff that their family’s throwing away, look at the stuff that’s rotting in their refrigerator, all that kind of stuff, and then to see, this apparent change in the global environment, they can see that waste streams that don’t have loops, things that don’t loop create enormous, outward, progressing difficulties...Going to that landfill is a real eye-opener because you just see that it is a one way thing from the sun to plants to the manufacture of every conceivable thing on the planet, and then going into great big holes in the ground, and things aren’t looping the way they need to loop...So anyway, so that’s my strategy to get them to see that if loops were made rather than linear, that we would have a more sustainable planet...I’m hoping to be able to create a visual sense for them of linear streams and looping streams. (Interview 2, Part 2, 5/14/09)

The goal described here by Mrs. P also fits into her broader goal of raising students’ awareness regarding consumption and its negative consequences for the planet. By taking students to the landfill, she hopes students will internalize what they have been discussing in class when they can see for themselves where their own waste stream ends. Students rated the field trip with 11 points (out of 16), indicating that for many students, this was perceived as an influential experience.

Town Meeting Regarding Wetlands Development. *Aim/Purpose: Sense of Place, Citizenship, and Empowerment.* The mock town meeting was the first one Mrs. P had held in her teaching career. Along with help from the researcher, Mrs. P created a scenario where a developer was attempting to build affordable housing on local wetlands that were part of a public recreation area used by hikers and hunters alike. Since the
majority of students in the class have had experiences in the local woods, this was an issue to which they could relate. Additionally, many of the students in the class live in affordable housing, and so have a direct understanding for this need as well. Students were assigned to groups of two to three students and given a role that they would play at the town meeting. They were given two full class periods to do their own research in the library (using books or the internet) to prepare their position for the town meeting. Roles included: the developers, the town manager, social workers, birding enthusiasts, recreational users of the land, an engineer, etc. Reflecting upon the town meeting, Mrs. P states in her third interview (part 1, 6/25/09):

I think it is real important the way that the town meeting thing went. Kids got an opportunity there to experience sense of place. Their town was under an onslaught from a developer who was going to take away something that was possibly important in their town for a variety of different reasons. If they cared more about animals, animals were going to lose their habitat, or whatever it was, and through citizenship you can develop a sense of place, and this year, because of that exercise they had an opportunity to dabble in citizenship, and for somebody like Scott, he blossomed with that role that he had, and it changed the way the kids looked at him, and it changed his behavior in class as a result...I mean, now he’s becoming this student, but I think that he understood how much power you can have, and there were other kids that saw that. Kat saw that, Mariah saw that to a certain degree. Greg definitely did. There were a variety of kids that understood that they have the ability to control their world to a greater or lesser degree, and so even though it’s not sense of place in the fru-fru sort of touchy-feely kind of way, there’s something real about it for them that I think is equally important for them.

From this statement, we can see that Mrs. P’s intention with this activity was to provide students with an example of how local residents may become involved with an issue within a town like their own. She felt that this type of activity helped students to develop a sense of place through developing an understanding of what is at stake on a local scale, in addition to empowering students by giving them a voice in this mock town meeting.
setting. Students rated this activity with 9 points (out of 16), indicating that this was perceived by the students to be one of the most influential activities during the course.

**PETA Video and Other Documentaries. Aim/Purpose: Raising Awareness and Evoking Compassion.** Throughout the semester, Mrs. P incorporated several video documentaries into the class curriculum. Early in the semester, she showed a documentary relating population issues in India to the status of women there. Towards the middle of the semester, there was a video documenting the poaching activities in India and Southeast Asia, and the near extinction of several species in those regions. Additionally, Mrs. P held what she termed a “film festival” of documentaries related to the agricultural industry, including the film *King Corn*. A few weeks later she showed the most influential movie of the semester, which was a movie made by the People for the Ethical Treatment of Animals (PETA), which showed graphic footage of the meat-packing industry. Finally, in the latter part of the semester, the class watched two documentaries on the aftermath of the Exxon Valdez oil spill, one created by the people of Homer, Alaska whose lives were deeply affected by the oil spill, and the other by the scientists at Exxon-Mobil. Other films included Al Gore’s *An Inconvenient Truth*, a documentary of the Earth First! movement in the 1980-90’s, a documentary of the water pollution in the Mississippi River, and the anime film *Princess Mononoke*.

When asked during the interviews about her objectives in showing the above-listed films, Mrs. P said repeatedly that her goals were to raise students’ awareness of the various issues, and to evoke an emotional response from students, especially compassion. At the start of the semester during her first interview (2/4/09), Mrs. P describes the first film that she shows:
What will be the first thing that will be impactful, especially for the girls, is when I show them this CNN series of clips on how girls are regarded in India and in the Middle East, and it's so appalling to these girls to see how other girls their own age are thought of in these societies, and what they can't do. They'll be angry and they'll be sad, and they won't believe it, you know.

Mrs. P goes on to explain how she feels this video gives students a visual idea of the status of women in other countries, and she uses the film to connect the status of women to population issues, which is the focus of the first unit of the course. Mrs. P also says it can be empowering for students, if they realize that as victimized as they feel, that there are other kids their own age on other parts of the world that are also victimized in different ways, but very incredibly significant ways, like the status of women, and for them to see that girls their age may have it even worse, may be an elevating thing for them, and especially if you can inculcate into some of these kids this power that they have to help other people who are victimized. (Interview 3, Part 1, 6/25/09).

As the class moves into issues surrounding the forests and habitat destruction, Mrs. P shows the film on poaching and the film about the Earth First! movement and loggers in the Northwest. Her goals in showing these films fit into a larger context of broader goals for the course:

I think that, you know, if they get that even though humans are in charge, we have this terrible responsibility to be a conscientious custodian, or a caring custodian, and generally you see that after movies like the Siberian tiger movie. That usually arouses people's compassion and ire at the same time, but the awareness of what's going on plus their own innate desire to care for nature, so you'll see that come out then, and you'll see it come out sometimes when they look at the little spotted owl, and they think about how vulnerable that little thing is. (Interview 2, Part 1, 4/29/09)

It is evident here that Mrs. P sees these films as a way of evoking compassion and empathy in students in the hope that this will translate into a feeling of greater responsibility to care for the environment. Later in the semester, as an extension of the
“film festival” on agriculture-related issues, Mrs. P showed the provocative PETA video.

Here Mrs. P comments about the context and purpose of showing this film:

That occurs within the unit on food, and the food unit follows the ecology unit, and in the ecology unit they learn about trophic levels and about the efficiency of eating low on the food chain, and that all gets embedded into the greater issues of where our food comes from, tropical rainforests and all that kind of stuff, so that by the time they see that movie they understand that cows are destructive. So they go into the movie with half of their brain knowing that cows are destructive, and the other half of their brain wanting to eat a hamburger, immediately, at that moment, and often times as many hamburgers as they can possibly bolt down...Alright, and then they see the movie. The movie has usually a pretty big impact on them, and the goal for that is to raise their awareness of, once again, the cost of doing business. It raises the theme that continuously comes up in this class, which is the cost, the true cost of being an American, and so by demanding meat 7 days a week, often times 2 or 3 times a day, that cost becomes intense, and then even backing off of that to 5 days a week, once a day, saves not just animals, but it saves water, and it saves forests, and it saves habitat for all these things, so the goal is awareness, and then the goal is for them to make connections in any way that they can. (Interview 1, 2/4/09)

Mrs. P goes on to state that she hopes the video enhances “awareness, compassion, and then action.” She says in a later interview that as a result of watching the PETA video many students decide to either stop eating meat altogether or limit the amount of meat that they eat. She says, “It is always a goal of mine that they will act up for a better world” (Interview 2, Part 1, 4/29/09). The students in the class ranked the PETA video itself with 12 points. The five other documentaries cumulatively earned 16 points, showing that students perceived these videos to be particularly influential.

**Alaska National Wildlife Refuge Debate. Aim/Purpose: Understanding Both Sides of an Issue.** During this activity, students were provided with fact sheets presenting both sides of the Alaska National Wildlife Refuge debate regarding whether or not drilling should be allowed within the refuge. After reviewing this information, students were divided into two groups to brainstorm the pros and cons of both sides of the debate.
The following day when students arrived to class, they were assigned to either the pro-drilling or anti-drilling side of the debate. Each team was given approximately 15 minutes to come up with their arguments and which team member would present each argument. For the remainder of class (75 minutes), teams went back and forth presenting and responding to each others’ arguments. Teams were given a point for each original argument, and each individual student received her own points for contributing to the debate.

The teacher, Mrs. P, describes several goals for the Environmental Science course which are exemplified by the ANWR debate. These goals include understanding that there is more than one side to every environmental issue, how to make a good argument, and learning how to think critically. Mrs. P states:

Showing two dramatically different sides to an issue, I think always works with them... and one of the important things for me in teaching the course was in getting to understand that there’s always two sides to every one of those issues, and that even though I tell them what my bias is, all I want them to do is show me that they can make a good argument, whatever side they take, just make a good argument. (Interview 3, Part 1, 6/25/09)

Later in the interview, when Mrs. P is asked if providing students’ with multiple sides of an issue, as is done in the ANWR debate, confuses students, she replies:

Yes, of course it does. On the one hand, they want to be told what to think cause it’s easier. They would rather just be, “Just tell me what you want me to think here,” but of course I don’t want to do that, and the same thing happened when I taught at [the university]. Kids got really angry with me because I wouldn’t tell them what to think, and then by the end of the course they understood that it was better to actually think through how you think. So, I’m okay with them being confused. I think that with this material almost more than any other material that they take throughout their whole high school career, I think that the weight of it, the importance of it is manifest down the road. They have to go out and live a little bit and see how this material fits into what their experience of life is, and I think that critical thinking skills take a really long time to develop, and I know
that they’re not going to become critical thinkers at the age of 16 or 17, but I feel like I ought to-, I have a responsibility to try to push them that way, even though they might be confused by it. (Interview 3, Part 1, 6/25/09)

From these statements, Mrs. P makes it evident that she realizes the importance of

presenting other positions besides the environmentalist view on the issues being
discussed if she wants to keep students engaged, and she wants students to develop the
ability to think for themselves about the issues and come to their own conclusion. This
activity was not included on the activity survey because the debate took place after the
activity list was created.

Class Discussion Format. Aim/Purpose: Getting Students to Think. In this

Environmental Science course, the teaching strategy used most regularly was a full class
discussion guided by the teacher using a form of inquiry referred to as the Socratic
Method. The Socratic Method is defined by Webster’s on-line dictionary as

A method of teaching by question and answer; used by Socrates to elicit truths
from his students. The basic form is a series of questions formulated as tests of
logic and fact intended to help a person or group discover the truth about some
topic. A skillful teacher can actually teach students to think for themselves using
this method. This is the only classic method of teaching that is known to create
genuinely autonomous thinkers. (http://www.websters-online-dictionary.org)

In this class, Mrs. P elicits responses from students through this questioning, which
organically leads to the next question. In describing this method during her first interview
(2/4/09), Mrs. P explains:

I ask questions a lot, and try to get conversations going, just to get them thinking.
Maybe I’ll come up with some essential question that I ask at the beginning of the
day that I am going to come back to at the end of the day, sometimes I do that.
Um, sometimes my teaching strategy is to act out – I actually act, I do things that
you see over the course of the semester that, you’ll see, they just can’t believe that
a teacher is doing this, but they remember that stuff, and so it’s just everything
that I do is orchestrated around keeping them engaged cause I feel like if they stay
with me, I have the best chance of having some kind of an impact.
From this vignette, it is clear that Mrs. P adds her own personality to the Socratic Method relying sometimes on acting, and often on personal stories (noted in field notes from multiple dates), to keep students actively involved in the discussion. On most days of class, a large percentage of class time is spent using this discussion format. It could be called the "default" teaching strategy, as it was what the teacher felt the most comfortable enacting. Mrs. P makes it clear that the goal of these discussions is "never to try to force anything on anybody. I just am telling them what the story is, and then they have to make the decision themselves, and I said that a million times" (Interview 3, Part 2, 7/1/09). Mrs. P is expressing her hope here that by providing students with environmental knowledge, they will come to make their own environmentally responsible decisions. The class discussion format was not included on the activity survey because this activity took place on an almost daily basis during the course and would have been too difficult for students to rank accurately compared with the other activities, which occurred only once during the semester.

Taking Students Outdoors. Aim/Purpose: An "Enhanced View of Nature." In this Environmental Science class, despite block scheduling and a white pine stand directly outside the school, this class spent only two class periods outside in the woods. The first day the researcher brought tree coring equipment from the university, and demonstrated with students help how to core a tree. Students also recorded other data, such as canopy height, % canopy cover, tree types present, and DBH. Mrs. P then led students on a short hike through the pine stand. The second day Mrs. P took the students outside was a day towards the end of the semester when the seniors were not in class (about a third of the class). Mrs. P began with a brief lesson on tree identification and
edible plants, and then took students on a short hike to the creek. The tree coring activity was included on the activity survey, and received 4 points, indicating that it was influential for some students.

We see from the following quotes from Mrs. P's first interview (2/4/09) that she intended to take the students outside much more than she did:

E: Do you ever take them out to the woods back there?
P: All the time, in the spring, yep, we go out there a lot...You know, there’s not a lot of diversity out there because the woods were granted to the town of Danville to be forever Pines, and so all the understory is always cut out of it, and, so, but I do have a unit that my class will do on tree identification in the spring.

Mrs. P adds later in the interview:

Another thing that I’ve done with huge success is to let there be enough green on the trees to go out and play a pretty sophisticated game of hunter and prey...It’s a good lesson for them, and they have fun, and they get to ram around in the woods, and then after it’s all said and done, there’s edible plants in that woods, so we sit down and we harvest some wintergreen berries, and it tastes like wintergreen gum, right....and, so they get a kick out of that, and they taste other things, and it brings nature a little bit more in a more knowable way.

Finally, Mrs. P concludes that “being out in nature in a really rowdy way, in a kind of a care-free way, or in a way that is like a team-building kind of thing, gives them, I think, an enhanced view of nature.” Reasons for such limited time outdoors, despite these intentions, are presented in the social interactions section below.

Effects on Student Identity

As was indicated in the theoretical framework, students’ emotional responses to activities were interpreted as resulting from aspects of their identity either being affirmed or disconfirmed by messages to which they were exposed during class. This section first explores the disconfirmation of students’ identity through the ecological footprint and “list of everything they own” activities, followed by two examples of identity affirmation
through a connection with student’s previous experiences outdoors. Finally, examples are provided from the class field trip to the landfill and the various documentaries shown in class that affected students’ identities in both positive and negative ways.

**Disconfirmation of Student’s Consumer-Materialist Identity.** The clearest evidence of disconfirmation of students’ consumer-materialist identity comes from an analysis of students’ comments regarding the ecological footprint activity, as well as the “list of everything they own.” For the majority of students who completed the ecological footprint during class, they were very surprised when they found out the “number of Earths” it would take to support the human population if everyone lived like them. Two students specifically described emotional responses to this activity during their interviews. For example, a student named Kat, when asked how she felt about the ecological footprint activity, comments:

K: Well, I was surprised because Americans take up at least 7 Earths, and then I was sad because, I don’t know, I’m one person, and for everybody to live like me, you would need like 3.15 Earths.
E: Right, yeah, it’s pretty shocking, huh?
K: Yeah, I think I started to cry in class.
E: Oh, so does that make you want you to like change anything you’re doing, or what does that make you think about?
K: Economically I really can’t change anything because of the pressure.
E: Yeah, so how does that make you feel, sort of like frustrated, or-?
K: Yeah, because I’m stuck between a rock and a hard place. I can’t change, but, you know, I want to. (Interview 1, 2/12/09)

The emotional response exhibited here can be interpreted as resulting from a disconfirmation of this student’s consumer-materialist identity, as she is questioning her materialistic values. This was a common response of students to this activity, although students experienced different levels of surprise, frustration, or sadness. Interestingly, another interviewee also stated that he did not know what to do to change his behavior
further while living at home. This student, C.P., comments, “I mean there’s only so much that I can do, you know, as a teenager to change my lifestyle” (Interview 1, 2/19/09). The importance of helping students to overcome this frustration is discussed further in the Discussion and Implications section below.

The homework activity where students created a list of everything they own was discussed by two students as having a significant impact on them. For example, when a student named Allan was asked during his second interview (4/15/09) if he’s done anything in class that has made him care more about the environment, he responds:

A: Probably the thing that made me care the most about the environment would be when we were doing population and Ms. P had us write the list of everything that we had, and then just seeing how much stuff we actually have. Even if we didn’t do a complete like-, I didn’t write down everything that I had, but the things that I did write down, I had a full page, so it’s like, that’s a lot of stuff. For her to say, other people in other countries don’t have like an eighth of that, so it’s just ridiculous.
E: Yeah, so how did that make you feel?
A: Like we use a lot of our resources to get stuff that we don’t necessarily need to survive. They’re not necessities; they’re things that we want, so-
E: Right, did that make you feel bad personally?
A: Yeah.
E: Like in terms of your own lifestyle?
A: Yeah.

Again, from this response, it is evident that this activity is emotionally affecting this student as he struggles with his materialistic values, thereby disconfirming his consumer-materialist identity. Another student, Payton, describes taking this experience to another level, where it begins to affect her behavior. When asked during her third interview (6/11/09) about the most influential activities in the class, she responds:

P: The other thing was the inventory that she made us write down everything we have. I was like, “Oh my god. I have so much stuff” cause I actually like sat there and wrote and wrote and wrote, like everything, and I got to the point at the end where I was just like estimating cause I was like, “400 pony tails.” I was like, “Oh my goodness.” I was like, “I have so much stuff. It’s ridiculous.” It is really
ridiculous how much stuff Americans have, like I don’t know why we produce so much when we don’t need it.

E: Right, so did any of those actually have an effect on things you do in your life?
P: Yeah, I don’t buy things that I don’t need really now, or like want really, really, really bad. If I’m just walking through Walmart and I’m like, “Oh, I could use some new pony tails.” I’m like, “Oh, but I have 400 at home” so I don’t buy them, like I think about it.

E: Oh, okay, so you’re thinking twice before you buy stuff.
P: Yeah, I think twice before I buy stuff, and it costs money to buy stuff and I don’t have money. I’m a teenager. Things are expensive.

Here, Payton is questioning the value she has previously placed on material items, as her consumer-materialist identity is disconfirmed. Payton responds to this disconfirmation by incorporating this new awareness into her consumer decision-making, which has led consequently to a strengthening of her environmental identity as she sees new value in buying less “stuff.”

**Affirmation of Students’ Environmental Identity.** In their description of the two days that students spent outside, students’ comments indicate that their environmental identity was affirmed by this experience, as the value they placed on spending time outdoors was echoed by the teacher. For many of these students who have spent a significant amount of time in the woods growing up, this class time outdoors was a reinforcing experience. For example, from the following description by Payton, the excitement that students felt during their second day outdoors is evident:

We went in on the trails, and first we started talking about the trees, and then Ms. P just gave up on talking about the trees cause nobody wanted to talk about the trees, and then we saw, um, like plants and she had us eat a plant that was like milky or something, and there was lady slippers, and there was butterflies, and like the caterpillar nests in the trees, and we went to the river, and we skipped rocks, and then there’s like a trail all the way across the river that you can go on, but it’s like a tiny, tiny path and like it was full of branches and stuff, and Gary and Mike and Cameron and Nathan and I went across that path and we got muddy and cut up from the pickies and the branches, and I lost my sandal and Cameron lost his sneaker. (Interview 3, 6/11/09)
Students clearly enjoyed getting out of the classroom, and perhaps learned something about the local flora. An indication that this time outside actually had an impact on students is seen in Payton’s comments, when asked later in the interview how the time spent outdoors during class affected her. She states, “I saw a lady slipper the other day, and I actually stopped and really looked at it for the first time like ever. I actually like was like, ‘Oh, that’s a lady slipper’ and then I actually went and I looked at it, and I was like, ‘Oh, it’s pretty’” (Interview 3, 6/11/09). Two other students remarked that going outside to see the trees helped augment their learning about the local environment. For example, Juan comments during his second interview (4/16/09), “I’m a more hands-on person, so she brought us out to the Pines, you know, she showed us this is what’s happening, not just saying this is what’s happening in the textbook, you know, pictures, but uh, yeah-” Kat says similarly: “I liked being outside. I liked being able to see what we were talking about, like she’s all like, “Blah, blah, blah, trees, trees, trees” and then I could just look at the tree, and be like, “I see it” (Interview 2, 4/8/09). Going outside was generally a positive experience for students, which could be interpreted as a strengthening of their environmental identity as their value of the local environment was reinforced in the class.

Students’ environmental identity was also affirmed by discussions in class about the importance of the old growth forest and the tropical rainforest. This affirmation occurred as the link with students’ established values regarding their own experiences in the local woods was extended to an appreciation of these other types of forest. During a cogenerative dialogue that occurred toward the end of the tropical rainforest unit, I asked the three students present, Greg, Juan, and Mariah, if they “feel any sort of personal
connection with what we’re talking about or if it just feels like sort of issues that are, you know, far away?” (Cogenerative Dialogue C-4, Cogen 2, 3/26/09) The students, Mrs. P, and the researcher have the following discussion in response:

M: I feel slightly connected because when I was little, I used to just go hang out, sit in the woods, but I feel very jealous of those people that have those forests around them because they’re really pretty.
G: Yeah, pretty cool. It’d be cool to see.
M: I mean, like compared to that our forests aren’t really that, what is that word?
G: Biodiverse [Everyone laughs because Greg knows this word].
M: But, it’s just a really nice place for relaxing, and it’s a good thinking spot, so-
Researcher: Okay, so you’re saying that you feel like you are connected to them because you have forests around your house, or no, that’s not what you’re saying?
M: Yeah, that’s what I’m saying, like it’s different there than it is here-
Researcher: A different type of forest, but you can still relate to it because we have our own type of forest here.
M: Yeah.
Mrs. P: I think it’s a really great question though. I wonder about it too. So, I’ve been talking about these forests far away, does it mean anything?
G: I guess, but not really. I mean, it’s California. I don’t live in California. I don’t know. I don’t seem too connected by it. I mean, yeah, you’re kind of learning about it and learning what’s going on over there, but I don’t know, I don’t really feel connected, I guess...
Researcher: M-hm, how about you, Juan?
J: I’m kind of same way, but at the same time, I love woods. I used to when I was a kid, I used to go out in the woods to explore, and, uh, I think when I was like 5, I used to go out in the woods and find like little pieces of rocks, and I’d be like, “Oh, sweet!” and I’d put them in my bag, and I had a big rock collection...but, yeah, like when I was little I spent most of my time in the woods, but this is, I mean, I don’t know. I mean, I do like to learn about what’s going on out there and stuff like that.

From this vignette, it is evident that students are taking pieces of the class discussion and relating it to relevant experiences in their own lives which have contributed to their environmental identity. This connection serves to affirm this aspect of the students’ identity as their previously established value of the local woods is reinforced. For Greg, it is more difficult to make this connection. This discussion suggests that the more a teacher can help students connect their own experiences with the discussion in class, the more
likely the students are to engage with the topic. In the above dialogue, this type of connection could be seen to be eliciting positive emotions in students, as they recall their childhood memories in the woods.

**Mixed Effects on Students’ Identity.** Other activities had mixed effects on students’ identity, including the class fieldtrip to the local landfill and the various films shown in class. Overall student reaction to the fieldtrip is focused around surprise at the size of the landfill, as well as positive impressions regarding the recycling process and piping the landfill’s methane for conversion to energy and use at a local university. A student named Barrett, who is normally one of the least engaged in class, when asked about the landfill trip, comments:

B: It was huge.
E: Yeah, so did you think overall that they were doing a lot for the environment or not so much?
B: They were doing what they could… but not everyone recycles, so stuff ends up in the landfill unfortunately, but I mean they had gigantic blocks of aluminum and plastic and everything in that shed, or not a shed, but that barn thing, so you could tell that they were doing something.
E: M-hm, yeah, what was that for?
B: They were just like bottles and cans crunched up into a block, into like big blocks, just as a way to make them smaller so that they can be shipped and everything, cause they’re recycling.
E: Yeah, so was anything surprising to you that you saw there?
B: No, not really, other than how massive the landfill was, and we got to see the new landfill, the new landfill they were building. It was pretty big, too. There were still tractors down there digging it out. (Interview 3, 6/11/09)

All of the interviewees who had attended the field trip, like Barrett, seemed to gain a new awareness as a result of seeing the massive quantities of trash on the landfill trip. For some students, the trip may have strengthened their environmental identity by providing a visual experience of how the process of recycling can be effective at limiting the amount of trash that ends up in the landfill. Another student, C.P., seems to have his already
strong environmental identity affirmed by the trip. When asked during his third interview (6/4/09) about his reaction to the landfill trip, C.P. states, “That was a lot of fun. I mean, it was really enlightening, like what they have there, how much they’re dedicated to like the renewable energy, like they use all the methane, and either they use it to produce the electricity that they use or they pipe it up to [the university].”

For other students, the experience may have been disconfirming, especially in combination with the “consumption” activities discussed above. For example, Payton remarks during her third interview (6/11/09):

They drove the bus up on top of one of the landfills and there were machines that were squishing all the stuff down in the ground, and you could just see them driving a big bulldozer over like plastic lawn chairs and everything, like cardboard and like all that stuff that you were like, “Oh my goodness, like that’s going into the ground, and then they’re going to grow grass on top of that?” It was just weird to see.

For Payton, the visual impact of seeing the items going into the ground was significant. For each student, the trip seemed to have an important effect, whether it was raising their awareness, affirming or disconfirming their identity.

From analysis of the student comments during the interviews regarding the movies shown in class, it is evident that these films often evoked an emotional response from students, at times strengthening their environmental identity as they learned about environmental issues that were meaningful to them, and at times disconfirming their consumer-materialist identity as they learned more about the consequences of their own consumptive behavior. One of the films that seemed to do both was the film about India’s population growth and the status of women. This movie served to disconfirm students’ materialistic values as they saw how few resources many people in India have upon which to live. At the same time, especially for the female students in the class, this was
an issue that appealed to their value of fairness. This film provided an application of this value to a specific environmental issue, thereby expanding students’ environmental identity through a new awareness. One of the most passionate responses to a video is from Mariah after seeing the film about India and the status of women. She comments:

M: I didn’t know that India had so much population growth. I knew that they disrespected women over there, but...seriously, they need to get some new laws. Honestly, I wouldn’t stand for that. If someone like mentally or physically abused me, I’d abuse back, cause- It’s just crazy.
E: Yeah, but how did that make you feel when you saw that movie?
M: Angry. Very angry, I was tearing at my paper like this.
E: Yeah, but who did you feel angry towards?
M: Um, the country itself, because if the country didn’t have those laws- , well, it isn’t exactly laws, but standards stating that women were lower, when we’re actually equal...is just infuriating, and any person who thinks that they should treat another human being so horribly, I think they need to be shot. (Interview 1, 2/18/09)

The three female students who were interviewed all reported feelings of shock and horror at seeing the lives of girls their age. Heise’s affect control theory (Turner & Stets, 2005) is helpful in understanding that when the culturally expected “performance role” of women is not met in this film, it causes a negative reaction for the students. One student, Kate, in trying to relate to these women, states that if she were born in India, “I’d probably be dead now, or married or something” (Interview 1, 3/4/09). Kate is fifteen years old. For many students, this is the first time they are being exposed to this type of information. In another example, Payton, expresses her feelings after seeing the movie, which she ranked the number one most influential activity for her:

That really was like, “Oh my goodness. We have tons of people.” Then what it makes me think of is the size of Danville, and how many residents we have in Danville, and how tiny Danville is in [this state], and then all the other states we have compared to that, like we have so many people that live in America, like that’s crazy, and how in India we see them searching through the trash and like all
of that, and that movie was very like, “Wow.” It made me like step back, and kind of like not be selfish for a couple minutes, and be like, “Wow. Look at those people searching through the trash. I feel bad.” (Interview 3, 6/11/09)

Clearly, this movie had a significant impact on Payton, since she is discussing it almost four months after seeing it. It seems to have made her reconsider her own materialistic values, thereby disconfirming her consumer-materialist identity. As we saw in the discussion of the “consumption activities” above, Payton ultimately begins to change her decision-making around buying material goods that she does not need.

Two students also reacted particularly strongly to the video about poaching. After seeing the video, one student explains why he feels this is one of the world’s most serious environmental issues:

B: The poachers that are killing endangered species - it’s not like you’re going to die, like with elephants, it’s not like you’re going to die without ivory, so what do you need it for? Why are they really killing these things? It’s completely pointless, but at the same time it’s making the biggest effect cause like with the elephants and everything, it’s affecting it a lot cause if say the elephants go extinct, that could create issues, or...Tigers, there’s already been how many, how many of the types of tigers have been killed to extinction? We only have so many left, so if they all are killed to extinction, then there’s no tigers, which means there’s really not many predators for the smaller animals that live out there, so they’re going to get overpopulated, and then there’s going to be no grass, and then they’re all going to start dying, chain reaction.
E: Uh-huh, yeah, so you feel pretty strongly about that.
B: Yeah.
E: Yeah, it’s kind of disturbing, huh?
B: Yeah, very actually. (Barrett, Interview 2, 4/9/09)

Another student, Rick, who is often overtly critical of the class and the teacher, states, “I really feel for animals. I think animals have just as much of a right to be here as us, as humans, but I don’t think we should just be able to kill them for their skin and their horns and stuff, just cause we think they’re cool” (Interview 2, 5/4/09). It seems that throughout the class, there are various issues that students grab onto, and it is often different issues
for each student which affects him or her more intensely. In this case, students which care for animals as part of their own environmental identity are deeply affected when they see how these animals are being treated by other human beings.

Overall, the examples in this section demonstrate the profound effect that many of the class activities had on various aspects of student identity. By either strengthening their environmental identity or disconfirming their consumer-materialist identity, these activities had an impact on students often leading them to reconsider some of the underlying assumptions they held about their relationship with the environment. Through student expression of various emotions, including surprise, awe, frustration, anger, and compassion, we see elements of students' identity being challenged and their perspectives broadened.

**Student Relation to Content**

One of the main factors determining how students were affected by the various activities was how students related to the content of the course. Issues that arose under this theme included whether students felt the material was presented from a one-sided or a balanced perspective, whether they could connect the content with their lives, and whether they felt that information came from a reliable source and was accessible to them. The activities of the Alaska National Wildlife Refuge debate as well as the class discussions are used as examples to discuss the first of these topics. The context of the town meeting is used to analyze the relevance of course content to students' lives, as well as the importance of accessibility of information for students. Finally, the local landfill trip and the documentaries are used as examples to demonstrate how the source of the information impacted students' learning.
The Teacher’s Presentation of the Issues: One-sided vs. a Balanced Perspective.

Throughout the semester, students’ opinions about the teacher, who served as the source of information during class discussions, changed as the class moved from topic to topic. How students viewed the teacher’s presentation of the material seemed to have a significant impact on students’ acceptance of new information. At the beginning of the semester, most students reported liking the Socratic dialogue format and how it was used by the teacher to create an open forum for discussion. For example, during his first interview, C.P. says:

I like the fact that Mrs. P will introduce a topic, and she won’t necessarily have us do an assignment on it, but she’ll have us, you know, debate it, essentially, and she’ll call on everybody...Like letting kids draw their own conclusions, letting them figure it out rather than just, you know, giving them a test and having them memorize it until they take the test and then forget it. It just seems like they’ll retain it more, and that’s one of the things I like. (Interview 1, 2/19/09)

Towards the middle of the semester, however, when issues got more controversial over topics related to the agricultural industry and meat-eating practices, students felt that the teacher became less open in listening to students’ opinions that contrasted with her own. The following vignette from class (3/26/09) is an example of a class discussion during the agriculture unit. The questions quoted in this vignette were student generated from a previous assignment. In this interchange, Greg is responding to some of Mrs. P’s comments:

P: Okay, let’s see, now why farmland is so needed, oh, it’s a good question, “Why does the world need to tear down rainforest in order to get farmland?”...It is the demand for meat. It is the worldwide growing demand for meat...I think we went over this when we were doing energy flow, to raise a pound of meat on a cow-G: Twelve pounds of grain.
P: Okay, that cow has to consume twelve pounds of grazing stuff, so the cow eats twelve pounds worth of corn or silage or-, twelve pounds! So, that takes a lot of land to raise twelve pounds, and that’s only one pound of cow, that’s not the cow. That’s just one pound of that cow, so if there’s 500 pounds of meat on a cow,
multiply 12 times 500 and you come up with, probably 6000 pounds of grain to produce an animal from which you are going to get 500 pounds of meat….Alright, so one of you asked, “What can we do about the problem in tropical rainforests?” How can we begin to solve that problem? So, one thing you can do, if you are a carnivore, and most Americans love their beef-, if you eat meat say twice a day, if you have a meat sandwich for lunch and meat for dinner, um, and you do that seven days a week and a lot of people do, a lot of people really eat a lot of meat. I know when I was growing up, I ate a lot of meat. Um, cut out a meat meal a week, one meat meal a week.

G: And what do I eat? Salad?
P: There’s a whole world of things to eat besides meat.

During a cogenerative dialogue, a video clip of this vignette was shown to students, and students were asked for their response to Mrs. P’s comments. One student, C.P., replies that her argument was one-sided, and Mrs. P sometimes fails to present the other side of these issues, such as the monetary benefit for the farmers or ranchers who need to feed their families (Cogenerative Dialogue, 03/31/09). Other students voiced frustration during their interviews during this period as well. For example, the following vignette is taken from Kat’s second interview (4/8/09), when asked her opinion of Mrs. P:

K: She’s a very nice lady and she’s an okay teacher. She just needs to watch what she says, and put more thought into it. I mean she puts lots of thought into it. She just doesn’t put thought into how people are going to react to it.
E: Hm, okay, do you have an example there?
K: Like the whole opinion thing. I mean, C.P. tried to argue his opinion, but she was all like, “No, you’re wrong, end of story,” so she might want to think of how other people might feel.
E: Yeah, okay, so that’s interesting because at the beginning several people I interviewed, I think you did too, said that it seemed like it was a very open environment, and people could say whatever they wanted.
K: It is a very open environment, and you can say whatever you want. You just have to be careful because if it’s against what Ms. P thinks, then there’s going to be a fight.

Another student, Barrett, expresses a similar sentiment during his second interview (4/9/09), when asked his opinion of the class thus far:
B: I don’t know. I think it’s kind of opinionated a little bit. I don’t like that…It seems like it’s kind of like all Ms. P’s opinion, like “You should do this, you shouldn’t do that.” I guess most of it is true, but at the same time it’s her opinion.

E: M-hm, so how do you think she could present it differently? Would you prefer if it was a little more balanced?

B: Mm, yeah, like a little bit more her listening to our views a little bit more.

In contrast, however, other students thought that throughout the semester, Mrs. P was able to present the issues in a balanced manner. An example of Allan’s perception of a balanced presentation of an issue is the following:

I actually think she presents it both ways because when we were talking about the logging, she doesn’t like the fact that the logging is going down [as in “happening”], but she’s not so far on that side to not understand that people’s jobs are going to be lost if we just stop logging altogether, so she presented the fact that we’re losing all these resources, but we need that resource too, to build houses, to build other things that we need. (Interview 2, 4/15/09)

In addition to the logging issue, which many students agreed was presented fairly, the Alaska National Wildlife Refuge debate is another example of the teacher’s attempt to present students with two competing views regarding an environmental issue. In the third interview, students were asked how their ideas were impacted by the ANWR debate. For some students on both sides of the issue, the debate affirmed ideas they already had on the subject. For example, a student named Simon that entered the class with a strong environmental background, says the following:

I didn’t learn any particular facts about ANWAR, like my opinion on it is that obviously we shouldn’t drill and that’s basically what I felt about it since its inception, but it was really interesting to see the argument for drilling in ANWAR and I didn’t expect that to be nearly as compelling as it was. I mean, ultimately, it wouldn’t sway my own, but- (Interview 3, 6/12/09)

The majority of the interviewees, like Simon, said that they learned about both sides of the issue. In contrast, however, rather than affirming a prior belief, three students specifically commented that they now understood both sides of the issue better, but were
unsure where they themselves stood on the issue. The following comment by Mariah is an example:

M: The issue is a very important one, but I don’t know which side to support because, let’s face it, the economy’s in shambles right now and gas prices are skyrocketing again, yet the caribou, I mean, the wildlife. If they go and see a pipe sticking out of the ground where they were going to have their baby, they’re going to be like, “What is this?”
E: Right, yeah, so you could sort of see both sides of the issue.
M: Yeah.
E: Yeah, okay, so you weren’t sure really where you came down?
M: Yeah, I still don’t know where I stand, so I don’t really support either, so-
(Interview 3, 6/10/09)

The uncertainty expressed here and by other students reveals that they have gained an awareness of both sides of the issue, but do not have enough experience with the topic or “they have to go out and live a little bit” as suggested by Mrs. P, before they establish a firm opinion for themselves. As Mrs. P states, she is “okay with them being confused” for now. Suggestions for how teachers can help scaffold students’ argument assessment skills are discussed further in the Discussion and Implications section below.

By the end of the semester, after she showed the videos on both sides of the Exxon Valdez oil spill issue, and had the ANWR debate, all student interviewees, with the exception of one, agreed that she adequately portrayed a balanced perspective. When students were asked during the third interview how they felt about having a course where one of the objectives of the teacher was to influence their environmental attitudes and behaviors, almost all of the students interviewed said that they did not mind the nature of this course because they either were in agreement with Mrs. P’s views or felt that she had portrayed multiple sides of the issues, so students could decide for themselves. This finding is significant given that many Environmental Science teachers feel hesitant in
attempting to explicitly influence students' attitudes and behaviors. Implications of this finding are discussed more thoroughly below.

**Connection with Students' Lives.** While several of the issues in class dealt with national or global environmental issues, such as population growth, deforestation, and global warming, the mock town meeting was an attempt to create an experience for students around a local issue with which they could more directly relate. When asked about their reaction to the town meeting and how they thought it went, several students mentioned that they enjoyed the real-life nature of the activity, and one student, Allan, related the issue to the local area around the school, as follows:

The Town Meeting, the wetlands, I liked that. I think it was a good learning experience to see-, it kind of represented like what happens out there in the real world because everyday I'm sure that there are people that are trying to get permission to build big housing, houses or things on the wetlands, and even if, I'm thinking about it right now, and the Rec [school gym] was built on wetlands and the Danville Mall, and then when I go to Southampton, their tech center was built on the wetlands, and all of those are sinking right now. (Interview 2, 4/15/09)

Here we see Allan applying what he has learned during the town meeting to places that he already knew about. Another student, Greg, discusses how the town meeting has helped him to understand that there are often multiple sides to an environmental issue, and in real-life it is not always clear which side to support. In his second interview (4/15/09), he states:

G: It really makes you have to come up with an argument, you know, come up with a reason cause I can think of reasons why it's good, or I can think of, you know, ten reasons why it's bad. I can-, I think both ways. I'm so neutral. I'm right in the middle. It's like well, we shouldn't do this and that. Well, hey, if you do this and that, then that might happen.
E: Yeah, does it seem like this project is realistic to you?
G: Yeah, it does actually cause this could really happen, you know. This could be so real life. I mean this could-, this could really happen.
It seems, then, that as a result of the town meeting, these students gained knowledge as to how a public debate regarding a local issue occurs. Whether the town meeting enhanced students’ sense of place, as Mrs. P hoped, is less clear, but when students can relate the town meeting to local experiences, as Allan does, students are using culturally relevant knowledge to build their understanding of their relationship with the environment.

During the class field trip to the local landfill, students had the opportunity to visit a landfill directly in their community. Many had been either to the landfill before or on walking trails that are located next to the landfill, but none had previously driven to the top of the landfill or toured the recycling facility. Since many students in the class had experience fishing in the river that passes directly by the landfill, this local, real-world interaction was an engaging way for students to learn about the consequences of linear waste streams. Allan, who had been on the walking trails before, recalls from the trip:

A: We went up to where the new dump was, where the new hole was being dug, and that was kind of cool cause it’s dug as deep as it can be stacked high, and it’s really, really deep, cause they had a dump truck at the bottom of it, and it was just kind of like, “wow.”
E: So, are the hiking trails that are there, are they maintained by C.M. [the landfill management company]?
A: Yeah, it goes right out to the Eisenford River and you can fish there, and apparently they’ve got it so that you can fly fish that year round now, and they stock it with trout.
E: Okay, that’s really cool that they keep the river clean enough for that, right next to the landfill.
A: Yeah, because the Consecro River and the Eisenford are both protected rivers or something like that, and the guy that gave us the tour was actually, he’s like the president of the board of protected rivers. It’s kind of amazing how the dump could be in the middle of both these rivers and both these rivers can still be perfectly fine, perfectly clean.
E: I guess that’s a testament to the company.
A: Yeah, and Springside gets their water at the bottom of the dump, and it’s perfect-, they take samples at the top of the dump, and it’s just as clean as when it goes to the bottom of the dump, if not cleaner. (Interview 2, 4/15/09)
This vignette demonstrates Allan’s positive reaction to the information provided, with which he could make a direct connection from his own experiences. In the next section the importance of the source of this information is highlighted.

**Source of the Content.** In the section above entitled *The Teacher’s Presentation of the Issues: One-sided vs. a Balanced Perspective*, we saw the importance of how students’ view the teacher as a source of information. The above example from Allan’s interview regarding his reaction to the landfill demonstrates how a local “expert” can sometimes have a significant impact on students in a different way than the teacher can. During the landfill trip, the information was presented by the president of the board of protected rivers for the town. From the above vignette, it is evident that Allan views this man as a reliable source, since he has a significant role in the effort to protect the local rivers. Allan could also relate to him as a local fisherman as well. This shows that it can often be a positive experience for students to hear from local community members about local issues, rather than exclusively obtaining their information from the teacher or other resources available in the classroom.

A different source of information in this class was the multiple films shown during class. Throughout the semester, Mrs. P emphasized that students should pay particular attention to the bias expressed by the makers of each documentary. Often after a video, Mrs. P discussed with students the biases which they had observed in the film, giving students the opportunity to assess the film’s validity in a collective setting. An example of a strong bias within a film was the PETA movie, which focused almost solely on extreme aspects of the meat-industry in making an argument against eating meat in
general. A typical response was similar to that of Allan when he is asked during his third interview (6/3/09) about his reaction to the PETA video:

A: My reaction, I don’t know, I was like-, the reaction to the animals, I was kind of disgusted, but I was kind of, I don’t know, kind of in denial I guess. I don’t think that happens everywhere. I mean I’m feeling pretty confident that doesn’t happen, that’s not how they kill them everywhere, so-

E: But you’re not too sure.

A: I’m not too sure...and, I don’t know, I just thought that the guy was kind of crazy too. I think he takes it a little over the top, beyond what needs to be done.

Allan goes on to say that the movie did not have any effect on his meat-eating. A common response of students to information that disconfirms their identity is searching for a way to discredit the source of the information. By labeling the PETA representative in the film as “crazy” Allan is able to avoid accepting the information presented.

Another student, Simon, explains during his third interview that he believes that films often make a more significant emotional impression on students than the teacher. In discussing Al Gore’s film, An Inconvenient Truth, he says, “Well, she’s just a teacher. It’s a film, somehow that has more heft and creditation than, you know, her spreading the word” (Interview 3, 6/12/09). For some students, then, a film might be viewed as a more reliable source than the teacher. It seems that the extent to which a student deems a movie a trustworthy source helps determine how significantly a student will react to the activity.

For example, one student that is deeply affected by the PETA movie, C.P., comments:

C: I was kind of disgusted by like what goes on in there, and I have been cutting down on meat that I eat.

E: M-hm, yeah, as a direct result of seeing that?

C: Yeah. I mean I still eat meat, but, you know, I try to eat less. So like instead of bringing a roast beef sandwich, I’ll have P.B. and J. (Interview 3, 6/4/09)

C.P., however, is the only student interviewee who changes his behavior as a direct result of seeing this movie. Four other interviewees specifically state that although they were
emotionally affected by the movie, they are ignoring this information to continue with their meat-eating habits. Here we see how new knowledge, even if deemed from a reliable source, is often not sufficient to bring about change in students’ personal lives and practices.

Students’ comments regarding the town meeting activity point to another issue related to the source of information, which is the accessibility of the material for the students. The sources of information for this project were books and the internet in the school library. As students attempted to prepare for their role in the town meeting, there was little guidance by the librarian or the teacher in navigating the library’s resources or finding relevant websites, which proved difficult for some students. For example, when Mariah, who was on the social work team, was asked her opinion of the town meeting, she replies, “It was stressful...I’m no good at research, so-, I’m just like, ‘Where’s this?’ and they had like no books on the social working conditions for that kind of thing in the library, so we just grabbed a bunch of stuff and improvised” (Interview 2, 4/30/09).

Similarly, another student, Juan, who was given the role of engineer because this was his desired career, used his own father who is a biotech engineer as his major source of information: “You know, trying to figure out a plan for like the septic system, um, that’s kind of challenging. My dad, he helped me figure some stuff out. He thinks that rock wall up on the hill with a fence, he thinks that’s a great idea” (Interview 2, 4/16/09). Juan also states later in the interview that this was the first time he had to prepare an argument like this before, which was also the case for Greg as well. These vignettes demonstrate the importance of providing students with the necessary support to feel successful in their research efforts.
Learning Style. Just as students may have difficulty with a task with which they have had little prior experience, students also expressed being challenged when their particular learning style did not coincide with the common discussion format of the class. A notable comment was made by Mariah during her first interview (2/18/09), who is very artistically inclined. When asked her opinion of the discussion format in the class, she replies:

M: I learn better with imaging stuff than hearing.
E: Mm, okay, what do you feel like you get out of the discussions?
M: Um, I get bits and pieces because I have ADHD and my mind kind of goes in and out even though I'm on my meds, so it's a little bit confusing, but I string pieces together.
E: Yeah, so every once in a while things seem to stick.
M: Yeah, sometimes it gets caught in there.

For students like Mariah who learn better from visual images, it may be difficult to concentrate during group discussions that last an extended period of time. Additionally, several students in this lower level class (at least three of the interviewees) are mechanically-oriented, and stated during their interviews that they strongly prefer hands-on learning like they do in the machine shop or building trades classes.

Many students in the class expressed difficulty with transferring the information they were hearing during the classroom discussions to their formal exams, and this was confirmed by their low performance on the tests. Students were continuously reminded to take notes, and the teacher often wrote highlights of what students needed to know on the board. However, many students had very weak note-taking skills, and said that it was difficult for them to figure out what they needed to know for a test. One student, Kate, makes the following recommendation during her first interview (3/4/09):
I’d rather do a worksheet cause then if I don’t know the answer or something, I can go up to her and be like, “Yeah, I don’t know what you’re talking about on this worksheet,” but when it’s like a big discussion, and I have no idea what she’s talking about, I’m not going to be like, “I don’t even know what you’re talking about,” so I just kind of ignore it, and I’m like, whatever.

This student is expressing that she did not feel like there was a time when she could ask the teacher for clarification. Another student, Juan, makes a similar suggestion regarding worksheets, for slightly different reasons. During his first interview (3/6/09), he says:

J: I’m more if I see it, then I’ll learn it, so I see, “Hey, I got that right” then I’ll say, “Okay, I know that it’s this or that,” so-
E: Hm, right, right, yeah, so it’s hard to tell sort of like what’s right and what’s wrong in the class?
J: Yeah, like on the last test, I don’t think I did very well on that. We had to write notes, but, I don’t know, she still didn’t give us enough paperwork about it.
E: Yeah, cause you don’t know exactly what you’re supposed to know.
J: Yeah.

Interestingly, Kate dropped out of the class mid-semester, and Juan ended up failing the course. Other students, however, also struggled with the note-taking aspect of the course.

One student, Greg, makes the following comments during his final interview (6/3/09), when asked what would have helped him to do better in the class:

I am awful at taking notes, even though I try. I just can’t take notes very well... but at least I tried, put an effort to it. I mean, that’s got to count for something... but your notes could be totally wrong, and then you think you have the right information, but it’s really not. Yeah, like I remember when we did that pie graph, I messed up on a part of it, cause I didn’t realize I did, and I was like, “I’m going to do really good on that quiz about this thing,” but, you know, I got it wrong because, I was like, “Aw, man, I put this in the wrong spot…”

Greg goes on to suggest that it might have helped if the teacher gave them “skeleton notes” where they had to fill in some of the information. This is a step the teacher could have taken to help students develop their note-taking skills. Without the needed support, many students were unable to transfer information from the class discussions to their
exams, and did poorly in the class as a result. This is a case where scaffolding of note-taking skills may have helped students to have a more successful experience.

In summary, this section highlights several of the ways that student interaction with the content of the course impacts their learning. The importance of presenting information in a balanced manner, as well as connecting the topics being discussed in class with students’ lives, is demonstrated by the students’ comments. Additionally, the results indicate that it can be useful to incorporate other sources of information besides the teacher in keeping students engaged, and that it is necessary to consider the different needs and learning styles of the students as the curriculum is designed and implemented.

Social Interactions

Throughout the student interviews, the effects that students had upon each other’s learning was often apparent. At times, these peer-peer interactions were positive and led to a productive learning environment for the students. In other cases, however, disruptive and inconsiderate behavior often led to negative interactions between students that were prohibitive to learning. Additionally, other students expressed discomfort emanating from self-esteem concerns about participating in activities which required them speaking in front of their peers. Examples representing each of these types of interactions are presented below.

Positive Student Interactions. The following examples demonstrate positive interactions between students during the town meeting project and during class discussions. During the town meeting, students reported largely positive experiences working with their teammates, perhaps because the assigned groupings intentionally placed students with their friends. Students, for the most part, took the project seriously,
and made an effort during class to prepare their arguments. As Greg prepared his argument, he stated, "It seems like some people are kind of getting into it, and I don’t know if others are or not cause I’ve been trying to, you know, get my paragraphs together about what I’m going to say" (Interview 2, 4/15/09). Mrs. P notes that because several key students in the class took the town meeting seriously, this had a positive effect on other students in the class. Mrs. P comments:

The one thing that did happen in our class was that Simon, when he finally found a voice, and Greg and C.P., I think were inspirational to some of the kids in the class, and that it’s possible during that town meeting that when Simon got up and said what he said, and with C.P.’s good performance on the video and stuff, that other kids may have been more inspired to make a more compelling argument. You know, there just seemed to be a little elevation in the quality of the conversation. (Interview 3, Part 2, 7/1/09)

Therefore, Mrs. P felt that engagement of students during the town meeting helped some students feel more empowered through the attention given to their point of view. This was an opportunity for students to stand up and be heard, which is something lacking in the lives of many of these students. It is unclear, however, due to lack of specific questioning of the student interviewees on this subject, whether the environmental topic contributed to their feelings of empowerment or if they felt a more general sense of agency at simply being given a voice in this setting.

Throughout their interviews, students also discussed positive peer interactions as a result of the discussion format. In describing his experience during class discussions, one student, Allan, comments during his third interview (6/3/09):

A: I think everyone kind of brought their own piece. A lot of other people have different opinions about other things than I do, but I think it’s good to see those other opinions and hear about them, and I think that influenced how I learned some of the things, and then of course you’ve got some people that just go to the class and goof off and give attitude all the time, and-

E: Yeah, whose ideas did you find were the most helpful or interesting?
A: Uh, C.P.'s, just because C.P., he knows a lot and he just, he likes to tell everybody.
E: Yeah, so that was interesting for you to hear his opinions on things.
A: Yeah.

Other students, such as Greg, also described positive aspects of the class discussions that were a result of students learning from each other, as they voiced their opinions. He states:

> You could definitely feed off of other people's info, and like, you get some information from someone and then you think of your own stuff. It's like, it like fuels your fire, kind of, you can just kind of feed off of each other, kind of...Knowledge is power, like Ms. P says, and it is, too. If you know something, you can win an argument. (Interview 3, 6/3/09)

This quote demonstrates that during the semester an atmosphere was encouraged in the class where students were able to use each other as role models in order to further their understanding of the issues. Evidence is lacking, however, regarding specific issues where students' views influenced each other during class discussions.

**Negative Student Interactions.** Unfortunately, there were also many negative interactions amongst students during class which often disrupted learning. Examples are presented here from the town meeting, class discussions, and taking students outdoors to highlight common issues that may arise during these activities. The first example demonstrates how student preparation is essential in a town meeting or debate format.

During the town meeting, the team of developers who had a central role in the debate resorted to inappropriate verbal attacks when their poorly-formed arguments were attacked. Several students noted this group’s behavior and lack of preparation during the interviews. For example, Mariah states:

> I didn’t really like that whole town meeting bit because Rick and Payton were being very rude...Extremely rude. I found it very unacceptable. That’s why I was quiet the entire time. I was restraining myself from saying something bad. I just
kind of wanted to go up there and smack both of them across the face very, very hard... They were acting very immature and childish and they weren’t prepared, obviously, and the whole, “People on low income are losers” statement from Payton should have gotten her kicked out of the room... That was terrible. (Interview 2, 4/30/09)

On the opposite end of the spectrum, a particular student in a debate may dominate the activity if she is more prepared than others. This can frustrate other students and compromise the effectiveness of the exercise. For example, a student named Kat, comments:

K: I felt C.P. was just-, he said we were ignoring everything, but no, he was doing a fair amount of ignoring. It’s hard to debate with C.P. He is a very bad debater.
E: Bad, in what sense?
K: He does not lose. He does not accept losing. You can tell him flat out, “No, you’re wrong,” yeah. (Interview 3, 6/8/09)

To minimize either of these types of interactions during a debate, it is essential to have a structure in place for the debate that students are aware of ahead of time, so that all students know the expectations and do not feel that certain students are dominating.

Suggestions on what form this structure might take are presented in the Discussion and Implications section below.

The next two examples represent issues related to the disruptive nature of this particular group of adolescents. Although the class discussion format led to positive interactions as discussed above, there were also aspects of the discussion format that did not work with this particular group of students. In discussing his opinion of the class discussions, Greg comments during his second interview (4/15/09):

I just get angry at students, at other people in the class cause they, I don’t know, some people say things that completely don’t even have to do with what we’re talking about and just, you know, take it out of hand sometimes or argue with the teacher about something that they know nothing about, and/or shouldn’t be arguing anyways...
Another student, Payton, when asked how other students in the class affected her
learning, replies:

    Cameron and Mike were negative on my learning, really bad. They goof off, and
Mike's really, really mean...The kids on the other side of the room, Barrett, and
Ron and Mariah and even Kat sometimes were just a pain because they were just
non-stop yapping, but that's okay because I'm that way too sometimes, just
sometimes it's interrupting. (Interview 3, 6/11/09)

Disruptions were abundant during any given class period, if not from students verbally
interrupting, then from calls on the loud speaker or students coming to class late or
leaving early.

Unfortunately, these types of interactions were often distracting not only for students, but
for the teacher as well, thereby limiting the depth of conversation in which the class could
engage.

    Due to the same disruptive behavior of the class, Mrs. P limited the number of
days she took students outside to only two, despite her intentions to take the students
outside more often. When asked why she did not take students outside more, during her
third interview (part 1, 6/25/09), she states:

    I knew that it would be chaotic because of the mix of kids. Normally, I try to
spend a week teaching kids how to identify trees, and these kids did not have the
discipline to make themselves go through and learn how to use the dichotomous
key and figure out what trees were-, which trees were which, and so I decided that
it would not be worth my while and my aggravation-, the aggravation factor
would have been enormous on that...The ones that couldn’t handle it were at least
half of the class, and they would have been completely distracting and all over the
place. It wouldn’t have had any value educationally.

When students were asked during the interviews why they thought Mrs. P did not take
them outside more, their reasoning was very similar to that stated by Mrs. P above. For
example, Greg comments during his third interview (6/3/09):
It was pretty cool to go outside and learn everything, but it’s hard for some teachers because some people just aren’t there when it comes to that, they’ll just mess around, as soon as they go outside, they just start something. It’s like a switch, they just can’t act like a normal human being…So sometimes that ruins it for teachers to bring kids outside. But, yeah, going outside would be fun, too, just cause you get out of the classroom. That doesn’t happen very often.

Another student Allan, corroborates:

I would have liked to have gone outside, but I think some of the kids are just too immature to go outside and actually-, cause Ms. P, it’s not her fault, it’s just people don’t pay attention when they go outside. They get crazy, so nobody will listen, so if you keep everybody in the classroom, then it’s fine. (Interview 3, 6/3/09)

Therefore, it seems these students, who were two of the older students in the class, perceived the same issues as the teacher. Again, several recommendations for how to overcome this difficulty are explored in the Discussion and Implications section below.

**Self-Esteem Concerns.** With an activity like the Alaska National Wildlife Refuge debate, there is an expectation that students make a statement aloud in front of their classmates. For some in the class, making this kind of statement was an uncomfortable experience. For example, Mariah disliked the debate because of the need to speak in front of her peers:

M: I don’t really have a lot to say usually, which is why I kept quiet for most of the debate. I don’t really like talking in front of my classes and stuff, unless it’s to my friends.

E: M-hm, why is that?

M: Um, well I have a really hard time making things sound plausible or intelligent, so I just feel, “Oh, god, they’re going to laugh at me” because I’ve spent like my entire life being laughed at for being a little out there, so-

E: Yeah, okay, so you didn’t necessarily felt comfortable, like you could say things. (Interview 3, 6/10/09)

This vignette demonstrates that some students may need more support than teachers realize in making an argument before their peers. For similar reasons to Mariah, Kat says
that she prefers to be an observer during class discussions. She states during her third interview (6/8/09):

I mean, I do have thoughts on it. I just don’t like sharing [those thoughts] particularly... Because I have a fear of being wrong and being made fun of, so if I say something that’s wrong and potentially really, really dumb, I’m afraid that somebody from over here will make fun of me.

Kat clarifies that she is speaking of other students in the class, rather than the teacher, who she feels does respect her opinion. Given this expression of discomfort, it is important that teachers are aware of how students may be feeling about presenting their ideas to the class, and take steps to ensure that all students feel encouraged to express themselves.

Overall, this section highlights various ways in which students’ social interactions can positively influence each other’s learning or be detrimental to the overall classroom culture. The students’ comments also demonstrate that individuals may feel uncomfortable with various types of participation in activities, and could use appropriate support. Several suggestions for establishing a safe atmosphere where students feel encouraged to become active members of the class community are presented in the Discussion and Implications section below.

**Discussion and Implications**

Since few studies have documented or assessed various activities in the Environmental Science classroom (Edelson, 2007), there has been little guidance for teachers in creating and implementing a curriculum that is effective for students. In this study, we have seen that the goals for this Environmental Science course included raising student awareness of environmental issues, evoking compassion, teaching students to think critically, self-awareness regarding consumerism, helping students’ gain a sense of
place, and augment their feelings of empowerment. While each of these goals is explored further in Chapter 5, the focus of this chapter was an exploration of the classroom structures which served as affordances and obstacles to meeting the established goals. Through the analysis of the student interviews and other forms of data, the results present multiple examples of how identity, student interaction with the course content, and social interactions contributed to the effectiveness or ineffectiveness of various activities by enhancing or disrupting students’ learning.

Using our initial framework of Stryker’s identity theory of emotions, it is possible to consider the activities as either affirming students’ environmental identity or disconfirming their consumer-materialist identity. For example, students spending time outdoors, the field trip to the local landfill, participating in the town meeting, are examples of activities that would likely affirm and possibly strengthen students’ environmental identity. In contrast, activities such as the ecological footprint, making a list of everything they own, and several of the videos, would have disconfirmed students’ consumer-materialist identity by raising student awareness of issues that question materialistic values. It is possible that after dealing with the initial distress that may result from disconfirmation of one’s identity, some students’ may choose to change their behavior, thereby strengthening their environmental identity as well. However, we have seen that there are several other mechanisms students use to avoid changing their identity when their values are disconfirmed. Most notably, we have seen examples of students denying that information with which they are presented is accurate due to the source, ignoring information, and interpreting new information in a way as to affirm one’s prior identity. McCall and Simmons (1978) refer to these responses to identity disconfirmation
as: “scapegoat the audience” by faulting others for the disconfirmation process; “short-term credit” where a particular episode of nonsupport for an identity is essentially ignored as a one-time event; and “selective interpretation” in which elements are accurately perceived, but interpreted allowing for identity affirmation. When fundamental aspects of their identity are challenged during the Environmental Science class, the findings of this study have demonstrated that students may respond in any of the above ways.

In order to get the most positive response possible from students, the study results suggest that it may be beneficial to couple these experiences which are provoking negative emotions with empowering ones where students have the opportunity to succeed in helping the environment, and can see an alternative to their consumer-materialist lifestyle. As there is a lack of research investigating how specific environmental activities elicit positive or negative emotions in students, it will be important to attempt to substantiate this novel finding with further research. The results from this study demonstrate that without these positive experiences, students may be left feeling angry and frustrated without any sense that they can make any difference through their own action. For example, it may be helpful for students to have an open discussion where students can hear from their peers about things they are doing to help the environment. During one such discussion regarding recycling, a student named Greg, describes to the class the following experience, which he also describes here during his third interview (6/3/09):

G: I would say, recycling and stuff, I throw my paper definitely in the recycling bin, or opposed to I would always just go to the garbage or something. [Now] I make the extra walk, like Mr. P., all his recyclables, all his stuff is in the back of the room, when the garbage is literally three feet from my hand.
E: Yeah, but you make the effort.
G: But I do, I definitely do, you know, like I don’t just throw it away, I can recycle it. So I’ve changed a lot that way, cause in the beginning of class, I was like, “Oh yeah, recycling [with a negative, sarcastic tone]” but it really makes a difference, you know, just a little one, but at least I’m going for it. I might be destructive here, so I’ll try to help myself here to kind of counterbalance, so- So that’s my point, yeah.

When Greg shares this commitment to recycling with the class, he is immediately praised by the teacher, and since he is seen as a “cool kid” in the class, others may look to him as a role model for their own behavior.

Another way to augment students’ feelings of self-efficacy is to have them participate in an environmental activity on a regular basis that benefits the school. For example, this class collected the recycling bins from each classroom each week as part of the school’s recycling program. The same student, Allan, who describes feeling badly after writing his list of everything he owns, makes the following realization as a result of recycling with the class:

I think that we need to use our resources less, and we need to use them more wisely. There are ways that we can cut out using a lot of stuff, like using recycled paper—that day that we pulled out all the paper [from the recycling bins] that had only been used on one side, and then using it. So, that’s just wasteful, so we could-, there are simple ways that you can cut down on the amount of resources that we use, and it doesn’t take all that much. (Interview 2, 4/15/09)

Overall, students gave recycling 9 points on the activity survey, indicating that several students perceived this activity as influential. By coupling activities that may cause some distress for students by disconfirming their identities with the opportunity to do something positive for the environment, this will strengthen their sense of self-efficacy and their belief that there is something that they personally can do to help.

Throughout the results, it was evident that students prefer to be presented with and have opportunity to discuss multiple sides of each environmental issue. Students
expressed frustration when they thought they were only being told one side of an issue, as the vignettes of students demonstrate towards the middle of the semester. One explanation for this reaction could be that the students' expectations of the "performance role" of a teacher include a balanced presentation of the issues. When this expectation is not met, Heise's affect control theory states that students may experience a negative emotional reaction to the situation (Turner & Stets, 2005). In contrast, when students perceived that they were being presented with multiple sides of an issue, such as with the Exxon Valdez movie and ANWR debate, they were much more likely to engage with the subject and consider the varying viewpoints.

It is also very important that students are given the opportunity, as was almost always the case in Mrs. P's classroom, for open discussion following a film. In this way, students have an opportunity to voice their ideas as they try to assess and work through the new information to which they have been exposed. As several guidelines for science learning now include reforms calling for higher levels of critical thinking (American Association for the Advancement of Science, 1993; National Research Council, 1996; National Science Teachers Association, 1992), films presenting the differing sides of an issue provide a relevant context for students to engage in critical thinking. Students also found it very helpful when Mrs. P guided them in assessing the biases in a film, and this aided the students in viewing Mrs. P's own opinions with more respect as well. In this way, the teacher avoids having to portray herself as neutral. If a teacher is open with students regarding her opinion, but still presents other sides of the issue, then students can take the teacher's bias into account as they consider the varying views. Additionally, the results showed that another way to avoid students' doubting the validity of the sources, as
students did with the PETA video, is to present multiple sources of information on each topic through guest lecturers, video, or fact sheets from a stated source.

Interestingly, the findings also demonstrated several instances where students were stymied when they felt valid reasons were offered on both sides of an issue which, in turn, led to claims of neutrality. These students could benefit from assistance developing their critical thinking skills, especially those of argument assessment, in order to help them understand that valid reasons on both sides do not mean that both sides of an argument are equally persuasive. While teachers often spend time encouraging students to take notice of the bias in various sources of content, as Mrs. P does throughout the course, the findings here suggest that students also need scaffolding in how to weigh the premises of an argument as part of the decision-making process. This could be tied in with the "larger lesson" that politicians and social activists from the left and right take positions on issues despite the fact that there are well-supported reasons on both sides. As students, they need to become comfortable with the idea that there are many issues without definitive evidence, and therefore, our positions are ultimately grounded in values and visions of what society “ought to be.”

There were also several important findings generated from students’ comments regarding the town meeting and the debate. While these activities helped some students to feel empowered and provided an example of “civic” engagement, there are several ways that the experience could have been improved for students. It was noted by Mrs. P and the researcher (Interview 2, Part 1, 4/29/09) that several of the students had much more information written down than they actually stated aloud during the town meeting. This made Mrs. P question whether or not students actually understood the information
they had written down. During this interview, the researcher suggested, "I think some of it too might be that a lot of them have never had to do that sort of debate format before, and that's a skill, using the information that you have to actually make a public argument." Mrs. P also adds the possibility:

Well, in high school, there's this tremendous-, there's all of these sort of counter pressures in the classroom—who's going to laugh at me, you know, I really like this guy, but you know, I don't think he likes me, so I'm not going to get up and say very much, you know, all sorts of political stuff going on.

The solution to these concerns may be giving students more opportunities to practice their debate skills, either by rehearsing their argument with the teacher, or as Mrs. P suggests, "maybe proceeding a town meeting with a debate on something might have sharpened their skills a little bit in terms of getting them to understand how important it is to come prepared" (Interview 2, Part 1, 4/29/09). Mrs. P adds that "the town meeting might have been more meaningful if the kids either had more time for research or had information presented to them that they could then synthesize from" (Interview 2, Part 2, 5/14/09). While town meetings are a wonderful forum for getting students engaged in a local issue, it is important that the teacher assess the debate and argument skills of the students in the class, and provide the necessary scaffolding to help them make the activity a successful experience.

As was noted in the results, the Alaska National Wildlife Refuge debate was very loosely structured, with teams going back and forth without time restraints, and often reiterating the same points over and over again. In order to avoid this constant rehashing of the same point, C.P., who has had previous experience with debates in other classes, comments:
I don’t think it was structured enough, cause I’m used to-, in my class I’m in right now, in my C-Block class, we do a lot of debates, they’re very structured, like you have a three minute opening statement, and then you have a two minute break, and then each team has two minute rebuttals and then there’s a two minute break, and then there’s another round of rebuttals and another break, another round of rebuttals, another break, and then another three minute closing statement...And like her [Mrs. P’s] statement that, you know, you shouldn’t need any breaks in between, I don’t agree with that at all, cause, I mean, yeah, you should already know the stuff, but you can’t just come up with it instantly and have everybody, you know, knowing what to say when.(Interview 3, 6/4/09)

C.P. went up to the teacher, Mrs. P, directly after the debate and expressed his frustration at the lack of structure, and presented his suggestion for providing more structure as he suggests in the vignette during his interview. From the following statement by Mrs. P during her third interview (part 1, 6/25/09), it is evident that she agrees with C.P.’s feedback and plans to incorporate it into future debates:

I think that it should have been more structured, and I know that when I have debates with kids like this, what I need to do is have specific questions that both teams get asked, and then they answer, they respond, and have it like that, back and forth, four times. That’s the end of that topic and we move on to another topic. Otherwise, they go back and forth...and nothing ever gets resolved. Yeah, for me, it showed me what I needed to know about any debates in the future.

Having more structure may also have helped students like Mariah who did not feel comfortable inserting her opinion with the more unstructured format. It would also be recommended that students have an opportunity to practice their statement or argument before having to do it in front of the class, if this is possible, in order for students to gain more confidence in their own ability to make such a statement.

Another format which may work well for students with higher rates of low self-esteem is a non-debate, collaborative model of issue exploration in which the class works together to find a solution or compromise position together, which is referred to as a “collaborative controversy” type of activity (Bredehoft, 1991). This is an example of a
cooperative learning experience, which has a different focus from more traditional competitive learning experiences. Slavin (1987, 1988) defines cooperative learning as "instructional methods in which students of all performance levels work together in small groups toward a group goal. The essential feature of cooperative learning is that the success of one student helps other students to be successful" (cited in Bredehoft, 1991, p. 122). A study by Johnson et al. (1990) has shown that this type of collaborative learning experience leads to higher levels of self-esteem, higher level critical thinking skills, in addition to increasing students' motivation and positive attitude toward a given subject. Therefore, this may be an effective teaching and learning strategy to employ with lower level students in an Environmental Science course where issue exploration is a focus of the curriculum.

In this class, there were particular aspects of the classroom that may or may not be the norm for other Environmental Science teachers. These elements need to be considered when interpreting the results of this study. For example, the "default" activity for this class was the Socratic discussion style that was the most comfortable for the teacher. When asked why she prefers this teaching strategy over more group work or projects, Mrs. P replied:

I think it may be a weakness in my teaching that I've never gotten used to doing a lot of group activities. Um, I love talking so much. I do. I love hearing what they think, and I love, you know, that whole back and forth dynamic, but it doesn't work over a long period of time. It's good every now and again, and so the reason that we didn't do more of it earlier on is because I don't think that I knew what I could do. (Interview 2, Part 1, 4/29/09)

Although this was the preferred teaching strategy of Mrs. P, given the feedback from the student interviewees, it may be helpful to limit class discussions with lower level students to a shorter amount of time, and use some kind of visual aid to help visual learners keep
their focus. In other Environmental Science classes, teachers may favor group work or worksheets, which only made up a fraction of the time in this course. Also, some Environmental Science classes may spend more time outdoors performing field studies or water quality testing.

Due to perceived behavioral issues in the class, the teacher in the research setting limited the number of classes spent outdoors. In order to overcome the issue of “rowdy” students and channel students’ energy into productive learning time spent outdoors, there are several steps a teacher can take to make the experience more manageable. One suggestion would be for the teacher to establish a strict set of enforceable rules and provide the students with a defined assignment and clear instructions. If the students have a project with specific data collection involved, for example, they may be more inclined to take seriously their time in the field. It is also helpful to have a second adult supervising students, if possible, especially for the first few days in the field. Using these strategies, a teacher may feel more comfortable taking students out of the classroom for a hands-on experience with the local environment.

Rather than focusing on hands-on projects or field studies, this course was built around case studies of different environmental issues that were presented in an interdisciplinary manner, exposing students to not only the scientific, but also the economic, social justice, and political aspects of the issues. Future studies should be conducted in classes which present the material differently with an alternative focus, in order to assess the similarities and differences in how students’ experience various modes of environmental learning. For example, some teachers may focus exclusively on the scientific aspects of environmental issues through an earth systems approach, whereas
other classes may spend large portions of the class collecting and analyzing field data, or organizing projects such as a school-wide energy audit (Edelson, 2007). More research is needed to document how students’ environmental identity and pro-environmental behavior may be affected by these different types of learning experiences.

Finally, one of the common themes throughout the activities in this course was helping students develop their sense of agency, not only in the classroom, but in their world outside the classroom. Through activities such as the town meeting, it was the hope of this teacher that students would find a voice that would enable them not only to be better spokesman for the protection of the planet, but for whatever cause they deem important. Coupling environmental education with the development of student empowerment should be considered as a teaching strategy, especially for teaching students in urban or underserved communities. More work needs to be done, however, in order to assess how this type of agency promoted in the classroom may translate into students’ lives.

Another tool for developing student agency is through participation in small group or cogenerative dialogues. These groups of a small number of students, which can meet either independently or with the teacher, have the aim of creating an open forum for students to reflect on experiences they have had in the classroom. If the teacher is included in this grouping, then it becomes an opportunity for the teacher to find out how students are dealing with the topics in class, and to adjust the curriculum and classroom structure accordingly (Bayne, 2008; Martin, 2004; Roth, Tobin, & Zimmerman, 2002; Tobin, 2007). Cogenerative dialogues were used in this study to gather data regarding what was working and not working for students in the Environmental Science course.
However, due to scheduling constraints limiting the number of meetings, the dialogues had limited impact on the teaching and learning in the classroom. Therefore, future studies are needed to assess the potential impact that these types of dialogues could have on the members of an Environmental Science class.

Overall, this study demonstrates from a sociocultural perspective how various activities in the Environmental Science classroom are impacting students’ environmental learning. The results highlight the ways in which students’ identity, interaction with course content, and social interactions influence their responses to experiences in the classroom. This data is meant to serve as a guide for teachers developing Environmental Science curricula by providing insight into the factors affording and prohibiting learning from occurring in the Environmental Science classroom. With further understanding of how students are reacting to activities in the class, it should be possible to improve the effectiveness of the Environmental Science course in engaging students in learning about the critical environmental issues which will be significant in their lives ahead.
CHAPTER 5

A INVESTIGATION OF THE GOALS FOR THE ENVIRONMENTAL SCIENCE
COURSE FROM THE TEACHER’S AND STUDENTS’ PERSPECTIVES

Despite the increasing role of the Environmental Science course within the high school curriculum, there has been little research into the guiding objectives that teachers are using as the basis for their curriculum. In the absence of standards at the state or national level for the Environmental Science course, teachers are using different strategies to design and implement this class. Using a sociocultural approach that allows for exploration of socioeconomic factors, social interactions, and cultural norms, this study investigates the goals established by one Environmental Science teacher and the reaction of her students to these goals as they are enacted in the classroom. Through qualitative methodologies including participant observation, formal interviews, videotape, and cogenerative dialogues, the data reveals the teacher’s reasoning for establishing the various goals for the course, as well as the students’ perspective on how they perceive these goals affecting them and their learning. The various goals set forth by the teacher and explored in this research include the role of science content knowledge and critical thinking as students are exposed to various environmental issues; developing students’ emotional connection with environmental issues; and empowering students’ to feel that they can make a difference through their own actions. Results illuminate areas where the teacher’s goals and student perceptions are in alignment, as well as those areas
where there is a discrepancy. The findings from this research are meant to inform the
greater science education community regarding some of the issues facing Environmental
Science teachers as they work to provide our students with an education regarding many
key issues affecting our environment.

**Introduction**

In recent years, the Environmental Science course has become increasingly
integrated into the high school curriculum as a component of the core curriculum, an AP
course, or as an elective (Edelson, 2007). There are unanswered questions, however,
regarding what the guiding objectives of the Environmental Science course at the high
school level should be. Should the class be taught strictly as a “science” course or as an
interdisciplinary course, inclusive of social, political, and economic issues? Should the
course have as one of its goals teaching students to *care for* the environment through
advocacy or should the focus be learning *about* the environment? Is it necessary for
students to engage in critical thinking as part of this course or develop an emotional
connection with the issues they are studying?

The traditional goals of environmental literacy that were established by the
Belgrade Charter in 1975 include improvement of the population’s environmental
knowledge, skills, attitudes, and behavior. The North American Association for
Environmental Education’s *Excellence in Environmental Education: Guidelines for
Learning (Pre-K-12)* (revised 2004) generally follow these categories in establishing their
set of standards for environmental learning at various grade levels. However, while the
constructs of environmental knowledge, skills, attitudes, and behavior provide a general
direction for education and research, their definition was not clearly delineated in the
Belgrade Charter, and it has been left to individual environmental education programs to interpret what should be the more specific objectives within these categories. Similarly, researchers have created survey instruments to measure these constructs (Bogner & Wiseman, 1999; Dunlap, Van Liere, Mertig, & Jones, 2000; Kuhlemeier, Bergh, & Lagerweij, 1999; Manoli & Johnson, 2007; Walsh-Daneshmandi & MacLachlan, 2006); however, there are often questions of construct validity related to these measures (Dunlap et al., 2000). Therefore, rather than assuming that the Environmental Science course should be guided by these same principles, this study attempts to question the usefulness of these constructs for teachers designing courses and suggests other possible approaches to thinking about the objectives for the Environmental Science course. For example, alternative goals that have been suggested by previous studies related to developing an environmental consciousness include: promoting students’ critical thinking skills (Longbottom & Butler, 1999); encouraging students’ emotional responses to environmental issues (Kals et al., 1999; Horwitz, 1996); or empowering students’ to feel that they can make a difference through their own actions (Meinhold & Malkus, 2005; Hwang et al., 2000).

While several studies in the science education field have considered the alignment of science teachers’ goals with their classroom practice (Bol & Strage, 1996; Fischer-Mueller & Zeidler, 2002), or conceptually argued for various goals of science education (Longbottom & Butler, 1999), little research to date has explored goals directly associated with Environmental Science courses. Additionally, prior studies have not considered the students’ reactions to the enactment of these goals in the classroom. Through the investigation of the goals established by one Environmental Science teacher
and the reaction of her students’ to these goals as they are implemented, this study highlights the various benefits of and challenges to establishing objectives for the Environmental Science course.

A sociocultural approach is used in this research in order to further understanding regarding why the teacher chooses to focus on certain objectives within the Environmental Science course, rather than others. This approach allows for a consideration of socioeconomic factors, social interactions, and cultural norms (Rogoff, 1990), placing the study results in the context of the given classroom and its associated culture. This approach also allows for an in-depth exploration of both the teacher’s and the students’ perceptions of each other within the context of the classroom, and how these perceptions are connected with the establishment of the goals for the course and students’ reactions to them as they are enacted in the classroom. During this six month investigation of the Environmental Science course, this study aims to address the following research questions (which are adapted from topical question #2 presented in Chapter 2):

1. *What are the teacher’s perceived goals in influencing her students’ understanding of their relationship with the environment and pro-environmental behavior?*

2. *What are students’ reactions to these objectives as they are enacted in the Environmental Science classroom?*

**Literature Review**

Recent calls for reform from the science education community (American Association for the Advancement of Science, 1993; National Research Council, 1996; National Science Teachers Association, 1992) have centered on changing the focus of science education to a “science for all” philosophy that takes students’ learning style and
cultural background into account (Longbottom & Butler, 1999). As courses move away from the goal of preparing future scientists, recommendations have been made as to how to more broadly engage students in the learning of science, ranging from designing courses that are more interesting and relevant to students’ lives; changing the teacher’s role from teacher-as-expert to facilitator of student-centered activities; and the mastering of skills and application of knowledge rather than memorization of disconnected facts (Fischer-Mueller & Zeidler, 2002). While there seems to be general consensus in the field of science education regarding the benefits of these reforms, there are other more contentious questions regarding the aims of science courses related to the extent that science teachers should encourage issue assessment and citizenship action through a science-technology-society approach (Longbottom & Butler, 1999) or promote science as the “best” way of knowing about our world (G. Aikenhead, 2001; G. S. Aikenhead, 1997; W. W. Cobern, 1994; Ogawa, 1995; Snively & Corsiglia, 2001).

Two informative studies have investigated teachers’ goals in the science classroom and the reflection of these goals in their teaching practices. A qualitative investigation by Bol and Strage (1996) explores the relationship between biology teachers’ stated instructional objectives and the kinds of assessment items on their tests and other course documents. Results of the interviews reveal that the teachers’ goals “primarily represented global, higher order objectives that emphasized learning skills, motivation, understanding, and the application of knowledge” (p. 152), in addition to study skills that involved summarizing, interpreting, and integrating information, as well as critical thinking (Bol & Strage, 1996). Results show that on average only 5% of test items across teachers were “extension” items that required application of information
beyond the given context, thereby suggesting an inconsistency between the teachers' goals for their students and the kinds of items to which students were exposed in their biology courses. Perhaps even more significant is the finding that teachers may not be aware of this incongruity, as the follow-up interviews with two teachers indicate. The authors cite earlier studies (Doyle 1983, 1986) suggesting that teachers may assign simpler tasks as a classroom management strategy, and that students reinforce this type of task to minimize the risk of potential failure. The study by Bol and Strage (1996) leaves out an exploration of student perception of these goals and their enactment in the classroom. Therefore, further research is needed to determine how the relationship between teachers and their students may account for discrepancies in teachers' avowed instructional goals and what actually occurs in the classroom.

Utilizing a different methodological approach, Fischer-Mueller and Zeidler (2002) investigated the congruency between science teachers' stated beliefs in contemporary science goals and their classroom practice. The research involved a case study approach of three science teachers, who were part of a cohort of nine teachers given the Contemporary Goals of Science Education Survey developed by Zeidler and Duffy (1994). Classroom observations and interviews with the three teachers were then used to determine the level of consistency between teachers' stated beliefs in the contemporary goals and their classroom practice. Results showed an average of 79% consistency between goals and practice for the three teachers. The specific goals which were not being enacted in the classroom are not discussed, so it is unclear where the discrepancies lie. Another limitation of the study is that the school was a member of the Coalition of Essential Schools (CES) and was very reform-focused; therefore, the results may not be
representative of science teachers’ goals and practices in a more traditional teaching environment. Additionally, the student population at the school was middle to upper class, and therefore lacked a full range of socioeconomic diversity. One of the questions generated by this study was: “How can research of this nature incorporate students’ perspectives of their science education relative to the teachers’ classroom practice?” (Fischer-Mueller & Zeidler, 2002, p. 56) Due to the lack of research investigating the student viewpoint on the goals of science education, the current study seeks to incorporate students’ perspectives by documenting their reactions to the implementation of the teachers’ goals in the Environmental Science class.

In a related study in English classrooms, Spera and Wentzel (2003) examined students’ and teachers’ goals for their students among ninth-graders and their English teachers. The goals investigated were broad educational goals and therefore not discipline specific. Using quantitative measures to assess students’ and the teachers’ emphasis on social, responsibility-related, learning, and performance goals, the findings show that while students reported pursuit of responsibility-related goals most frequently, followed by social goals and then learning goals, their teachers indicated that they encouraged student pursuit of learning goals most frequently (Spera & Wentzel, 2003). The results also show a difference in students’ own goals for themselves and their perception of teachers’ goals for them. However, this incongruency did not appear to be a negative predictor of student level of motivation (in the categories of interest in class, perceived support, or locus of control) (Spera & Wentzel, 2003).

In a similar manner to the Fischer-Mueller and Zeidler (2002) study described above, the Spera and Wentzel (2003) study approached the examination of students’ and
teachers’ goals through a previously established measure, thereby providing the participants with a set of goals to evaluate for relevance. Although this approach is an effective means of comparing student and teacher rating of those goals, other goals that are more specific to a given subject or that simply do not appear on the survey may be overlooked. Therefore, in the current study by allowing the goals to emerge from teacher interviews, direct teacher input was involved in determining which goals were investigated in depth during subsequent student interviews and classroom observations.

While the above studies provide insight into teachers’ goals for science education, there has been little research, if any, into teachers’ goals for the Environmental Science course. While some of these goals may overlap with the goals for science education in general, there may be goals that are unique to teaching about our relationship with the environment due to the more interdisciplinary nature of environmental issues, as well as the emotional responses evoked by students when learning about environmental problems.

In order to gain an understanding of the context for establishing goals for the Environmental Science course, we must consider the recent history of the environmental literacy movement. Emerging from the political activism of the 1960’s and 1970’s, the general population was gaining a new awareness of the impact modern society was having upon the natural environment. During this period, the Belgrade Charter was established at the International Workshop on Environmental Education in 1975 (UNESCO, 2007), defining the goal of environmental education as follows:

> to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively

However, since this goal was established, programs around the world in both the formal and informal education sectors have utilized various approaches to environmental education, emphasizing different elements of environmental literacy as defined above.

One of the central debates in establishing an agenda for environmental education programs is whether focusing on science content knowledge is sufficient to bring about the other elements of environmental literacy, or whether environmental advocacy and action skills need to be explicitly incorporated into an environmental science program. Research findings have been unclear in establishing a relationship between environmental science content knowledge and the other aspects of environmental literacy, as defined by the Belgrade Charter, including associated changes in behavior. For example, in a large study of students at three high achieving high schools in three large US cities, Meinhold and Malkus (2005) found that a higher environmental knowledge score on their survey correlated with higher environmental attitude and behavior scores. Their knowledge survey, however, only consisted of eleven questions in a multiple choice format, and given that students were taking the survey in different cities, it is difficult to ascertain how strong a correlation exists between knowledge and attitudes and behavior. In contrast, Kuhlemeier et al. (1999) in their study of 9000 Dutch adolescents found a very weak correlation between environmental knowledge and the other variables of attitudes, willingness to make personal sacrifices, and environmentally responsible behavior. The authors conclude that “Students who possessed a great deal of environmental knowledge hardly seemed to be distinguishable by attitudes and behavior from other students”
The conclusion from these studies is that while environmental knowledge is correlated with environmentally responsible behavior, it is likely not sufficient to bring about change in students' pro-environmental behavior.

In contemplating the goals for an Environmental Science course, it is also relevant to consider the role that environmental knowledge and action opportunities play in development of an individual’s environmental identity. Environmental identity is defined by Thomashow (1995) as referring to “all the different ways people construe themselves in relationship to the earth as manifested in personality, values, actions, and sense of self” (p. 3). Similarly, Clayton (2003) defines environmental identity as “a sense of connection to some part of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the ways in which we perceive and act towards the world; a belief that the environment is important to us and an important part of who we are” (p. 46). With regards to the development of environmental identity, Kempton and Holland (2003) have found that awareness of environmental issues will augment the salience of individual’s environmental identity; however, this is only one of three stages of development of one’s environmental identity. The other two stages involve individuals participating in environmental action and gaining a sense of empowerment through these experiences (Kempton & Holland, 2003).

Interestingly, the research of Kempton and Holland (2003) and others studying the development of environmental identity have been almost exclusively focused on significant life experiences of adult environmental activists or professionals rather than either the general population at large or adolescents (Chawla, 1998; Chawla, 1998; Chawla, 1998; Chawla, 1999; Chawla, 1999; Kempton & Holland, 2003; Zavestoski,
and have not been directly aimed at developing goals for environmental education. For example, Kempton and Holland (2003) conducted 159 “identity interviews” with members of representative types of environmental organizations, where they investigated each participant’s history of involvement with the environmental movement, providing useful information regarding the process of environmental identity development among this group of individuals. However, little research has been conducted with the adolescent age group to investigate how individuals from a variety of environmental backgrounds may respond to pressure to become more environmentally responsible either in a formal or informal educational context (Zavestoski, 2003). By focusing on adolescents in a public high school, the current study considers how students’ environmental identity may interact with the enactment of the teachers’ goals in the classroom.

**Theoretical Framework**

As noted above, some of the teachers’ goals explored in this study could be considered common goals of the larger science education community, while others are more uniquely appropriate for an Environmental Science course; however, the distinction is somewhat blurred as environmental topics have become more common in the other science disciplines. This section explores the theoretical context surrounding several of the goals which are explored in detail in this study, including the goals of science content knowledge, encouraging advocacy, critical thinking, empowerment, and evoking emotion.

**The Role of Science Content vs. Advocacy**

The question of goals for the Environmental Science course is discussed by Edelson (2007), where he raises the issue of whether it is appropriate or not for an
Environmental Science course to move beyond teaching science content and its applications into the realm of encouraging advocacy. Edelson (2007) states that one of the benefits of the course is that as an applied science, it provides a context for students to understand how science relates to societal decision-making. He adds that "because the value of learning environmental science for personal and societal reasons is immediately apparent to students, environmental science is able to create a level of engagement among students that exceeds that in traditional disciplinary courses" (p. 45). However, Edelson (2007) makes the argument that the environmental science course should in fact be a course about the "science of environmental systems" (p. 53) and should not promote any type of advocacy in the realm of sustainability education. He believes that focusing on the science will make the course more palatable to traditionally conservative groups who might be against a course supporting pro-environmental action. On the other hand, we must consider the studies of Meinhold and Malkus (2005) and Kuhlemeier et al. (1999) described above, which failed to show that environmental content knowledge alone can account for students' environmental attitude or behaviors. Therefore, it is unlikely that a course focused solely on the "science of environmental systems" will bring about change in students' environmental identity above the level of salience, or new awareness, and into the more advanced stages of empowerment and activism.

As environmental science teachers attempt to define their goals for their students, teachers may consult the National Science Education Standards (NRC, 1996) or the North American Association for Environmental Education's Excellence in Environmental Education: Guidelines for Learning (Pre-K-12) (revised 2004). Within the National Science Education Standards, we find several environmentally-related standards for
grades 9-12. For example, the content standards include the topics of "population growth, natural resources, environmental quality, natural and human-induced hazards, and science and technology in local, national, and global challenges" (NRC, 1996). However, there is no discussion of specific themes that should be taught within these topics, or the role of high school courses in teaching action skills. In contrast, the North American Association for Environmental Education's *Excellence in Environmental Education: Guidelines for Learning (Pre-K-12)* (revised 2004) contain very specific suggestions for what should be taught at the 9-12th grade level, divided into the categories of Strand 1: Questioning, Analysis, and Interpretation Skills, Strand 2: Knowledge of Environmental Processes and Systems, Strand 3: Skills for Understanding and Addressing Environmental Issues, and Strand 4: Personal and Civic Responsibility (http://www.naaee.org/npeee/learner_guidelines.php). In these guidelines environmental knowledge is only one of four categories, while the others involve developing both analysis and action skills, in addition to a sense of responsibility for helping the environment on both personal and community levels. Despite the thoroughness of the *NAAEE Guidelines for Learning*, these are not well-known by environmental science classroom teachers and are therefore underutilized. The discrepancy between these two sets of standards is an indication of the variance that exists at the classroom level regarding whether the Environmental Science curriculum goes beyond teaching environmental knowledge into the categories of responsibility and action.

**Self-Efficacy, Agency, and Empowerment**

Among other factors that researchers have found to have a correlation with environmentally responsible behavior are constructs of self-efficacy and internal locus of
control. As these are not commonly discussed as goals for a science curriculum (Fischer-Mueller & Zeidler, 2002; Bol & Strage, 1996), there is evidence from recent studies that these constructs have a significant relationship with pro-environmental behavior (Meinhold & Malkus, 2005; Hwang et al., 2000), which suggests that these factors may be worthy goals for an Environmental Science course. The theory of self-efficacy established by Bandura (1977, 1986) states that an individual’s ability to effectively execute an action is influenced by her belief in her ability to do so. Meinhold and Malkus (2005) cite the definition of self-efficacy presented by Bandura as “the confidence that individuals have in their ability to plan and execute a course of action and to accomplish a task or solve a problem” (p. 512). In their research, Meinhold and Malkus (2005) hypothesized that the likelihood of adolescents to partake in pro-environmental action may be related to their level of self-efficacy, in addition to knowledge and attitudes. Their findings show a statistically significant correlation between self-efficacy and adolescents’ environmental behavior, measured by a self-report.

The construct of self-efficacy is linked to locus of control because of parallels regarding one’s perceived abilities to change or control one’s life (Meinhold & Malkus, 2005). Locus of control is defined by Hwang, Kim & Jeng (2000) as “an individual’s belief in whether or not he or she has the ability to bring about change through his or her own behavior” (p. 20). An internal locus of control leads to the expectation that one’s own activities will bring about change, while an external locus of control refers to the belief that changes happen by chance or by the actions of powerful “others” (Bandura, 1986; Gecas, 1989; Hwang, Kim, & Jeng, 2000a). In their study of 523 visitors to an urban forest trail in Korea, Hwang et al. (2000) found that internal locus of control was...
the most significant factor affecting environmental attitude and intention to act. As a result of this finding, Hwang et al. (2000) suggest that environmental education programs should focus on establishing a strong internal locus of control in their participants by encouraging people to make their own decisions, evaluate solutions, and act upon these decisions.

Another concept related to both self-efficacy and locus of control is that of agency, which has been defined as “the power to act and appropriate resources to meet one’s goals” (Lavan, 2004, p. 62). In the classroom environment, it could be hypothesized that if a person feels empowered during classroom activities (has a sense of agency), then this would lead to feelings of self-efficacy, whereas if she feels helpless, out of control, or taken advantage of (lacking agency), then this would lead to a lack of self-efficacy. The development of this sense of empowerment is potentially influenced by the power dynamics of the classroom. For example, describing the dialectical relationship between classroom structures and agency, Loman (2005) argues that “the dispositions to act, as a result of a person’s habitus depend on the capital the individual holds in the field of the classroom” (p. 174). In an article by Bayne (2008), she discusses the importance of both individual agency and collective agency in creating a supportive classroom culture that moves towards meeting its goals. As such, this is an important concept to consider within an Environmental Science classroom where both individual and collective agency may play a role in how students feel about their ability to “make a difference.” If students feel that they can access the resources they need to be heard and have a voice, then it would follow that they would be more likely to partake in pro-environmental action.
The Role of Critical Thinking

Since the 1980s, there has been a focus on reforming education to develop students’ critical thinking (Onosko, 1989). This emphasis is reflected in both the National Science Education Standards (NRC, 1996) and the NAAEE’s Excellence in Environmental Education: Guidelines for Learning (Pre-K-12) (revised 2004). Critical thinking is envisaged by Richard Paul as a set of characteristics, some of which may be observable in this study, such as “intellectual courage” (a willingness to consider the viewpoints of others) or “intellectual empathy” (the ability to put oneself in the place of others to consider their viewpoint) (Paul & Elder, 2001). While observing students and examining their comments to see if they are exhibiting these characteristics, this research also considers to a lesser extent the degree to which critical thinking skills are exhibited by students. As per Raths, Wasserman, Jonas and Rothstein (1986), these skills include interpreting and critiquing data and arguments, investigating assumptions, hypothesizing, and decision-making. While this list of skills is not exhaustive, and there is a debate regarding whether critical thinking should be conceptualized as a set of characteristics, skills, or as part of the natural development of conceptual understanding, that discussion is beyond the scope of this paper. The ideas listed above are meant to provide examples of the type of critical thinking that is practical to observe in the classroom.

A related concept to critical thinking is that of critical reflection, which is defined by Jack Mezirow, one of the founders of transformative learning theory, as a process by which we attempt to justify our beliefs, either by rationally examining assumptions, often in response to intuitively becoming aware that something is wrong with the result of our thought, or challenging its validity through discourse with others of differing viewpoints and arriving at the best informed judgment (cited in Taylor, 2001, p. 220).
In this definition, critical reflection is focused on an internal consideration of our own values and beliefs in comparison with differing viewpoints, which is similar to the characteristic of “intellectual courage” as described above. In the current study, both critical thinking and reflection are investigated as goals for the Environmental Science class.

Specifically, in the understanding of environmental issues, it is important for students to be exposed to multiple sides of the issues and to learn how to assess the arguments that they encounter. Longbottom and Butler (1999) present the example of utilizing local environmental issues as a means of raising awareness and involving students in critical thinking and social action. These authors make a broader conceptual argument that the goal of science education should involve encouraging students’ creativity, critical thinking, and rationality in order to move society in a more democratic direction. The authors view science education as playing a role in helping students to develop the skills needed to be active, critical members of society. An argument is made against science teachers’ presenting a positivist view or a postmodernist view of scientific understanding, and instead focus science instruction around case studies of current scientific work or “real life” problems with which the learner can become involved. Longbottom and Butler (1999) suggest utilizing local environmental issues for this purpose; however, they warn that presentation of the science involved in these types of issues often becomes oversimplified and therefore non-scientific beliefs may be reinforced without careful examination of the evidence.

In a study of teachers who exhibited varying levels of implementation of higher level thinking initiatives in their classrooms, Onosko (1989) found that teachers who
encouraged higher levels of critical thinking through their classroom activities were more likely to cite the development of critical thinking as one of their primary goals in their teaching. In contrast, teachers with lower levels of incorporation of critical thinking in the classroom tended to emphasize content acquisition as their primary instructional goal. Onosko (1989) summarizes these findings: “Lower scorers prefer to expose students to ideas and issues, whereas high scorers prefer to explore ideas and issues with students in greater depth” (p. 191). These results indicate that it may be important for teachers to have the development of critical thinking as one of their primary goals if this is an important student outcome for a particular course. Extending this research to the current study in the Environmental Science classroom, this research is aimed at determining if the development of critical thinking is a goal for the teacher and if so, how the enactment of this goal is experienced by students in the class.

Emotion and the Environment

Smith (2005) suggests that “the process of ethical becoming requires an emotional openness to circumstance that enables the previously determined boundaries of our being to be re-constituted and re-interpreted” (p. 220-221). In this statement, Smith is suggesting a connection between our emotions and what could be called our ability to critically reflect upon our underlying values, beliefs, and understandings. While guidelines for developing the curriculum for high school science courses now commonly include reforms that emphasize critical thinking (National Science Education Standards, NRC, 1996), these standards do not include any reference to the importance of creating positive emotional experiences for students in the science classroom. This is despite evidence from the field of neuroscience that decision-making is frequently guided by
emotions, often on a non-conscious level. Taylor (2001) explains how “contemporary research is revealing a more integrated relationship between the physiological process of cognition and emotion” (p. 222), as it has been shown that emotions play an important role in establishing the agenda for desires and beliefs, and they help us decide what to consider cognitively and how to respond. While it may not seem immediately clear how emotions impact science learning, there is significant evidence that emotions play an important part in environmental identity and decision-making (Horwitz, 1996; Kals et al., 1999).

Two studies in particular, those of Horwitz (1996) and Kals et al. (1999) highlight the role of emotion in defining one’s relationship with nature. Horwitz (1996) conducted a qualitative study of 29 environmental activists, during which the participants were asked to write about life experiences that gave rise to their environmental beliefs. Findings from the study state that both emotional love for nature and outrage at its destruction were commonly found in the participants’ responses. Kals et al. (1999) deliberately explored the role of emotion in influencing nature-protective behavior with a questionnaire study of 200 participants from the general population (of Germany) and 81 German environmental activists. These authors investigated the relationship between a theoretical construct, “emotional affinity towards nature,” and nature-protective behavior. Results showed that emotional affinity towards nature is as powerful a predictor of nature-protective behavior as indignation of nature destruction and interest in nature.

Various environmental authors, such as David Orr and Wendell Berry, have referred to an emotional connection with “place” as an essential component of the development of self and community (Berry, 1977; Orr, 1992, 1994). For example, Orr
(1994) states that “knowledge of a place – where you are and where you come from – is intertwined with knowledge of who you are” (p. 130). Clayton (2003) suggests that this connection to place should be “recognized, nurtured, and used to encourage conservation behavior” because, she adds, “the natural objects being protected are tied to the self, thus allowing the motivation to be internal rather than external” (p. 60). If an emotional connection with “place” does have a relationship with nature-protective behavior, as has been suggested by the above studies, then it is important to consider whether it is appropriate for an Environmental Science to help nurture this emotional connection in our students.

As we consider the establishment of goals for the Environmental Science class, these studies suggest two related paths in developing students’ environmental identity, including (1) through an emotional connection with nature or (2) through an emotional connection with specific environmental issues. In the current study, the first of these is not a primary goal for the Environmental Science teacher, while the second is a goal upon which she places much emphasis. Therefore, the goal of establishing an emotional connection with environmental issues was a focus of this investigation, while the first was not. However, this is not to suggest that establishing an emotional connection with nature is less worthy as a goal for the Environmental Science class, only that it was not explored in detail in this study.

As this study explores the teacher’s goals for the Environmental Science course, and students’ reactions to the enactment of these goals, it is important to consider these goals within the context of the science and environmental education communities. The goals of science content knowledge and advocacy, empowerment, critical thinking, and
an emotional connection with environmental issues are discussed here in order to provide
an initial discussion of the potential role of these goals in the teaching of environmental
science. Other related goals which are explored in the results include influencing
students’ behavior and presenting a balanced perspective of the issues. Due to their
overlap with the above-described goals, they were not explored in their own section in
the theoretical framework. Further connections between the goals are explored in the
results and the following discussion.

**Methodology**

**Setting and Participants**

This study was conducted at a public high school in the Northeast, chosen based
upon inclusion of an Environmental Science elective course in the school’s schedule,
teachers’ willingness to participate, a diverse socioeconomic student population, and
proximity to the research university for accessibility purposes. The school is located in a
suburban neighborhood, but is attended by students from rural areas as far as an hour and
a half away. The high school serves 1700 students with 23% eligible for free or reduced
lunch. In 2006, the school had an 80% graduation rate, with 38.1% of students going on
to four year colleges or universities, and in 2007, 101 students dropped out of school,
representing 6% of the student population (http://www.city-data.com).

The participants in this study were 10-12\textsuperscript{th} grade high school students (N = 17) in
an Environmental Science elective course, as well as their teacher, referred to in this
study as Mrs. P. The class was considered the lower level of two Environmental Science
classes offered at the school. Students had varying levels of participation in the study on a
voluntary basis, including participation in the class, surveys, interviews, and/or
cogenerative dialogues. Eight students and the teacher were interviewed three times over the course of the semester, and two students were interviewed twice. Nine students in various groupings participated in cogenerative dialogues, eight of whom were also interviewed. Students were asked to volunteer for participation in the interviews and dialogues, and were chosen based upon scheduling considerations. These students were representative of several levels of student achievement (ranging from failing the course \( N = 3 \) to obtaining the highest grade possible (A) for the course \( N = 2 \), with the majority of students in between \( N = 6 \), as well as a diversity of social groups within the class.

**Data Collection**

The ethnographic methodology selected for this study allows for exploration of the sociocultural context in which the teacher has developed her objectives for the course, as well as the factors that affect students' reactions to the enactment of these objectives. The research questions are explored through a subset of the following qualitative research strategies including: participant observation, videotaping, formal interviews, and cogenerative dialogues. The first layer of data collection, which can be characterized as ethnographic description, includes both participant observation and videotaping. The researcher attended class on a daily basis throughout the semester, allowing the researcher to observe the enacted curriculum. Field notes were kept daily in a field journal, including both reflexive and reflective sections (Emerson, Fretz, & Shaw, 1995). Observations focused on relationships and interactions among participants, both peer-peer interactions and student-teacher interactions, as they participated in classroom activities. Additionally, monitoring students' reactions to teaching strategies provided
insights that were explored at a deeper level through the other research methods. The class was videotaped approximately two times per week, specifically during interactive activities when there was discussion between teacher and students. The videos provide a record of classroom activities that serve to augment field notes, and were used to prompt discussion during interviews and cogenerative dialogues.

A second layer of data was collected through formal interviews and cogenerative dialogues. A diverse sampling of ten students and the teacher were interviewed during a series of three interviews at the beginning, middle, and end of the semester. Each student interview ranged from 30 minutes to an hour in length, and all interviews were audio-taped for later transcription and analysis. The first interview with the students focused on participants’ environmental background, initial impressions of the course, and students’ environmental beliefs and behaviors when they entered the class. The second interview probed more deeply into students’ environmental background and beliefs, in addition to focusing on students’ reactions to activities in class and peer-peer and teacher-student interactions. The questions during the third interview explored how students’ environmental beliefs and behaviors changed (or did not change) during the semester, which activities students’ found to be most influential, and what the affordances and obstacles were to change occurring. The teacher’s first interview was 70 minutes, while her second and third interviews were approximately 90-100 minutes in length. The teacher interviews focused on the teacher’s environmental background, beliefs, and goals for the course (Interview 1), the teacher’s assessment of how various activities were affecting students (Interview 2), and whether the teacher’s goals for the course had been met, and the obstacles and affordances to accomplishing these goals (Interview 3).
Nine students participated in cogenerative dialogues, which are group discussions amongst stakeholders (e.g., teachers, several students, and administrators) that “afford the examination of shared experiences within a field—a physical and temporal place where individuals interact with each other—in order to co-create new culture and/or amend that culture which already exists, as a means to improve the quality and efficacy of teaching and learning” (Bayne, 2008). The dialogue groups of three students, myself, and the teacher met approximately once every other week during the semester (starting six weeks into the semester) with groups shifting at mid-semester due to scheduling changes. The purpose of the dialogues were twofold in this study, serving both as a research tool for the researcher to gain insight into the reactions of students to various classroom structures and activities, as well as a potential method of improving the teaching and learning in the classroom by providing a setting where students and the teacher could openly discuss what was working and not working in the classroom and make suggestions to better their experiences in the classroom.

Data Analysis

In order to document students’ reactions to various activities that occurred during the semester, several techniques were used for analysis to ensure the rigor of qualitative research, including multiple data sources, multiple levels of analysis, code checking with other qualified researchers, as well as member checks with the teacher and three of the student participants in the study (Creswell, 2003; Guba & Lincoln, 1989). Analysis of the data occurred in several stages, beginning with analysis of the teacher interview data using NVivo 8 software.
“Focused coding” (Charmaz, 2006) was used to determine categories of objectives that were discussed by the teacher throughout the three interviews. The categories that emerged included (1) environmental awareness, (2) student empowerment, (3) presenting a balanced perspective, (4) promoting critical thinking, (5) evoking compassion or other emotions, and (6) influencing students’ behavior. Next, student interviews were reviewed and coded according to the above categories, and student reactions to the teacher’s objectives were clearly noted. The themes were coded for accuracy by a fellow graduate student in the education department to ensure reliability of the coding procedure. There was a 98% overlap in the distribution of codes, and the final 2% were discussed and negotiated.

Third, videotapes of the cogenerative dialogues were reviewed during a meso-analysis at regular speed, while recording a chronology of topics being discussed. Segments that served to substantiate or contrast with findings in the interview data were noted. During a subsequent micro-analysis, these vignettes were transcribed verbatim, and coded according to the emergent themes described above. No entirely new themes emerged; however, several of the themes were augmented with vignettes from the cogenerative dialogues, especially regarding presenting a balanced perspective. Additionally, field notes and classroom videotape were reviewed to ensure agreement between data sources.

Interpreting the Results

Due to the emphasis on emotion and identity in the current study, a framework provided by two symbolic interactionist theories of emotion from the field of sociology are utilized in the interpretation of the results. Symbolic interactionist theories of emotion
The theories of Stryker (2004) and Heise (cited in Turner & Stets, 2005) are described below, followed by an explanation of how each is used in the interpretation of the study results.

Stryker’s (2004) identity theory of emotion conceptualizes the role of emotions in the identity process by considering an individual’s emotional response to others’ reactions to one’s “role performance” of a given identity. When others affirm one’s identity, positive emotions are experienced, tending to raise the salience of that particular identity. The higher the identity is ranked for an individual, the more acute is their emotional response. In contrast, when one’s identity is disconfirmed, negative emotions are experienced, forcing the individual to reevaluate commitments to an identity. According to Stryker’s theory, a person will tend to develop an identity that is affirmed, while lowering an identity in the salience hierarchy that is not meeting the normative expectations of a social network.

This theory is therefore helpful in the context of an Environmental Science course in interpreting how a teacher might aim an experience towards affecting students emotionally through affirmation of their environmental identity or disconfirmation of their consumer-materialist identity. Additionally, in this setting, a student may exhibit a positive emotional reaction when her environmental identity is strengthened through a connection with an issue that affirms her values, while a negative emotional response could result from a discussion of environmental destruction or by questioning what has been referred to as the student’s consumer-materialist identity (Dittmar, Long, & Bond, 2007; Dittmar, 2007). As students are being asked on a daily basis to reflect upon their
fundamental values regarding how they view their own and society’s relationship with the environment, Stryker’s (2004) identity theory of emotions is referred to in the results and discussion to further understanding of students’ emotional reactions to their experiences in the classroom. In the next section Heise’s affect control theory is discussed as a useful tool in understanding how students are perceiving the teacher’s role as she implements her goals for the Environmental Science class.

Heise’s Affect Control Theory

As discussed above, Styker’s identity theory of emotion is useful in dealing with goals, such as critical thinking (students’ questioning aspects of their identity) and establishing an emotional connection with environmental issues, which may affirm or disconfirm a student’s identity. However, students’ reactions to other goals—behavior change, presenting a balanced perspective, and empowerment—require another framework for interpreting how the teachers’ goals are being received by students. Heise’s affect control theory is particularly insightful in gaining an understanding of students’ reactions when there is a discrepancy between their expectations of the teachers’ goals for the course and the goals as they are actually experienced in the class.

Also in the category of symbolic interactionist theories of emotion, Heise’s theory places emphasis on how individuals define the role of themselves and others within a situation. According to Turner and Stets (2005), this theory states that the level of emotional response to a situation is determined by the correspondence of what Heise calls fundamental sentiments, or culturally established expectations about identity roles and behavior, and transient impressions, or feelings about how individuals acting within a specific situation or event are meeting expectations. Within a situation, a classroom for
example, students will have culturally established expectations of how the teacher should act or behave. If this expectation is in alignment with the individual student’s transient impressions of the teacher’s actual behavior, then this student will experience limited emotional arousal. However, if there is a discrepancy between the fundamental sentiments and the transient impressions regarding the teacher, then this will likely result in a stronger emotional response to the situation (Turner & Stets, 2005). Figure 1 shows a Venn diagram demonstrating in Case A: complete overlap of an individual’s fundamental sentiments and transient impressions; in Case B: a significant gap between an individual’s fundamental sentiments and transient impressions. Heise uses the term “deflection” to refer to this type of incongruity, and suggests that individuals will seek to limit the discordance between the fundamental sentiments and transient impressions often through reconceptualization of the situation. For example, if a student perceives that a teacher is trying to persuade her to perform a pro-environmental action that she may or may not be interested in doing, and this is outside of the student’s expectation of the “teacher role,” then the student may experience a negative emotional reaction to the teacher’s behavior. As a result, the student may be inclined to reconceptualize the teacher as a “biased environmentalist” rather than as an “objective provider” of environmental knowledge. Both the establishment of goals for the classroom and the reaction of students to these goals are impacted by expectations of the “teacher role” and “student role” at this particular high school. Therefore, this theory is utilized in the interpretation of the results, as the teacher and students attempt to negotiate their roles within the Environmental Science classroom.
Figure 3: Figure 3 shows a Venn diagram demonstrating in Case A: complete overlap of an individual’s *fundamental sentiments* and *transient impressions*, resulting in a low level emotional response; in Case B: a significant gap between an individual’s *fundamental sentiments* and *transient impressions*, resulting in a high level emotional response.
Results

A significant portion of the third interview with the teacher, Mrs. P, was focused on how Mrs. P views her role as an Environmental Science teacher and what she hopes to accomplish with her students each semester. A summary of these often interconnected themes is shown in Figure 4.

Figure 4: This diagram represents the interconnectedness of the teacher’s goals for the Environmental Science course.
Teacher’s Goals: Awareness and Empowerment

Two themes that are repeatedly mentioned throughout the interview are that of awareness and empowerment. In the following vignette, Mrs. P discusses the importance of awareness:

As environmental educators, we have a responsibility to make awareness happen, and so you take that same person, and you find a way to make them aware that doesn’t make them go into denial or push you away. If you can find a way to make them aware that keeps the channels open and the interest level high—it’s awareness that empowers, then you can affect both of those things, and I think that we have as educators, we have a terribly responsibility, and I mean terrible in the sense that it’s so huge and it never goes away. It’s a responsibility to always impart awareness—(Interview 3, Part 2, 7/1/09)

In the context of Mrs. P’s dialogue, awareness could be interpreted as knowledge of environmental issues and human involvement in these issues from a factual perspective.

In addition to the importance of awareness, Mrs. P adds that an individual must feel empowered that she can make a difference in order for the knowledge gained to have a significant impact upon them. She states:

You get the knowledge, but in order for the knowledge to really have legs, you have to have a mentality that believes that there’s something that can actually be done. You have to, it’s that activist mentality, and by that I don’t mean that the person has to necessarily become an environmental activist, but I think that a person can believe in the activist ability that they have as a single person: “I can change the stuff that I do enough to suit the parameters that I’m going to define for myself as environmentally responsible,” and so somebody begins to act in a way that they feel like they have changed their own little paradigm, their way of being in the world has shifted, even if it’s only slightly. (Interview 3, Part 2, 7/1/09)

Carrying these ideas into her role as a teacher, Mrs. P states these goals clearly later in the interview:

I see my goal as simply raising awareness of the student and empowering them to understand that they can make a difference, and I think that if I can make them believe that they can make a difference, even if it’s a tiny difference, if they can
make a difference, then that will inspire an activist mentality and leave them more open to learning more in the future about what they can do.

Mrs. P continues with an explanation of why she feels these goals are often quite difficult to accomplish with her students:

I think the task at the high school level is really overwhelming because they’ve got pressure coming from every single side, most of the pressure to not be environmentally-responsible, and that has to do very much with-, well, there’s a lot of pressure on teens, but in the school where I’m teaching, there’s pressure to get as much stuff as they can, in order to gain whatever prestige they can in a community like that, and you know, sort of network climb as much as they can, and that takes buying stupid stuff.

Interestingly, Mrs. P describes how she views her approach as being different from a factual, scientific approach to Environmental Science. She states:

I think that there are other people in the department who present Environmental Science less passionately than I do. First of all, they don’t present it through the medium of an issue. They present it by giving the facts and figures about clear-cutting, and deforestation world-wide, and, you know, that kind of thing, but they don’t contextualize it in an issue, and that takes some of the advocacy out of it, I think. You know, this is the method of deforestation, from a knowledge-based kind of thing, and so, I don’t believe that that’s a good way to teach. I can’t teach that way anyway. (Interview 2, Part 2, 5/14/09)

Here we clearly see that Mrs. P’s goals for the course go beyond simply providing knowledge for students regarding the “science of the environment” (Edelson, 2007). She feels it is important to empower students through a more advocacy-based approach.

**Students’ Awareness and Feelings of Empowerment**

There are many examples throughout the student interviews demonstrating students gaining an awareness of environmental issues of which they were previously unaware. A typical example is presented below, showing how awareness may lead to an increased salience of a student’s environmental identity. Following this, several examples demonstrating the connection between awareness and empowerment are presented.
The following vignette from the third interview (6/3/09) with a student named Greg reveals the type of awareness students gained from their experiences in the course:

G: Say if I didn’t take the class at all, I wouldn’t know that it was making such an impact on what we’re doing, like we watched the *King Corn* video - that was a pretty good one too. It showed that all that corn, you know, what was it, it was Iowa, right? An Iowa farmer can’t grow, you know, can’t have a farm to feed his family, cause they’re just growing for cattle or for ethanol use, or just the corn syrup that’s in every soft drink. It’s such a big impact, like none of that corn goes to like actual eating it as corn.
E: Right, right.
G: It’s just weird, so that just shows you how much of it is being used cause there’s corn, like those big towers, they just filled right up. That’s insane... So it makes you think, it’s like that building is five stories tall, and you use it within, you know, however long it takes, it just doesn’t last. Every single year, it’s like, there’s not leftover corn, so, I mean, it’s pretty incredible.

As mentioned above, there are many statements throughout the student interviews where students show that they have gained an understanding of a specific issue, as Greg has in this example regarding the agricultural industry. The majority of these examples are unconnected with comments regarding behavior change and specifically issues of empowerment; however, the remainder of this section focuses on a few examples that demonstrate this connection for students in the class.

As students’ entered the Environmental Science class, many students were being asked to consider population issues and their consumptive values for the first time through activities such as an on-line ecological footprint. Two students in particular expressed disappointment in themselves and frustration regarding what they could actually do to change their lifestyle. The following vignette from the first interview with a student named Kat is representative of these sentiments:

K: Oh yeah, population – I was surprised it was that large because I used to live in Georgia, and there’s hardly any people there, so I haven’t had a lot of contact with people, so imagining 6.7 billion people just makes my head hurt.
E: Right, so was that surprising to you today, that activity, when you did the ecological footprint?
K: Yes, well, I was surprised because Americans take up at least 7 Earths, and then I was sad because, I don’t know, I’m one person, and for everybody to live like me, you would need like 3.15 Earths.
E: Right, yeah, it’s pretty shocking, huh?
K: Yeah, I think I started to cry in class.
E: Oh, so does that make you want to like change anything you’re doing, or what does that make you think about?
K: Economically I really can’t change anything because of the pressure.
E: Yeah, so does that make you feel, sort of like frustrated, or-?
K: Yeah, because I’m stuck between a rock and a hard place. I can’t change, but, you know, I want to. (Interview 1, 2/12/09)

Therefore, although the class clearly increases Kat's awareness of both population and consumption issues, Kat feels limited as to what she can change in her own life.

Interpreting this response utilizing Stryker’s identity theory of emotion, it seems that Kat is experiencing the negative emotions of disappointment and frustration as her consumer-materialist identity is disconfirmed by this activity, and she feels there is little she can do to amend her situation.

As the semester proceeds, several students including Kat begin to partake in environmental actions that they feel are helping the environment. During her second interview (4/8/09), when asked if she feels like she can make a difference in helping the environment, Kat states the following:

K: Well, even if I recycle one piece of paper a week, that’s better than some people do, and that’s making an impact on the Earth.
E: Mm, okay, so you feel like your personal action is important?
K: Yeah, cause at first you have to do what you’re preaching, and then maybe you can rope a few friends in to do it too, and then once you have a whole group more people do it, and then it just kind of piles on top.

Similarly, Greg expresses his feelings during his third interview about how his small-scale actions are making a difference. When asked if he has changed his behavior at all during the semester, he replies:
G: I would say, you know, recycling and stuff, I throw my paper definitely in the recycling bin, or opposed to I would always just go to the garbage or something. [Now] I make the extra walk, like Mr. W, all his recyclables, all his stuff is in the back of the room, when the garbage is literally three feet from my hand.

E: Yeah, but you make the effort.

G: But I do, I definitely do, you know, like I don’t just throw it away, I can recycle it. So I’ve changed a lot that way, cause in the beginning of class, I was like, “Oh yeah, recycling [with a negative, sarcastic tone]” but it really makes a difference, you know, just a little one, but at least I’m going for it. I might be destructive here, so I’ll try to help myself here to kind of counterbalance, so- So that’s my point, yeah. (Interview 3, 6/3/09)

These latter examples from Kat and Greg shows ways in which students’ environmental identity is affirmed through their environmental actions, leading to a sense of empowerment, which is the second stage of environmental identity development according to Kempton and Holland (2003).

Another common feeling expressed by students was that only if others participated in the action as well, would it have a significant impact. For example, a student named Simon, says that “it really takes the participation of the entire population” for an action to be beneficiary on a large-scale (Interview 2, 5/5/09). However, this does not discourage Simon from taking part in environmental actions because he sees other benefits in trying to do his part to help the environment. In contrast to these other students, however, one student remained skeptical throughout the course about the impact his actions would have upon the environment. Expressing a more cynical perspective, Barrett uses this sentiment to justify his lack of action:

B: Even if I stopped eating meat, I know everyone says you can make a big difference and everything, but even if just I stopped eating meat, there’s still millions and millions and millions of other people eating meat.

E: Right, so you don’t feel like your stopping would make any sort of impact or difference.

B: Not really.
E: Okay, but if others stopped eating meat, would you be willing to stop eating meat?
B: Mm, I wouldn’t stop, but I might eat less. (Interview 3, 6/11/09)

By the end of the class, Barrett was the only student interviewed who was using his feelings of a lack of self-efficacy as a reason for not participating in pro-environmental actions. This therefore seems to have stymied his movement into the empowerment stage of environmental identity development, although his awareness of environmental issues regarding meat-eating certainly increased. Barrett represents an important example of how an increase in awareness may be insufficient to change one’s actions, especially if this awareness is not coupled with a sense of efficacy in being able to make a difference.

Overall, however, it seems that although students may have been disillusioned at the beginning of class as to what they themselves could do to help the environmental situation, Mrs. P succeeded in raising the awareness of students regarding environmental issues and the impact of their own behaviors. By the end of the semester, she had also succeeded in helping empower several students to feel that their actions, albeit limited in scale, could make a difference.

Teacher’s Goal: Influencing Students’ Pro-Environmental Behavior

During the second interview (Part 2, 5/14/09), Mrs. P was asked how she judges whether the class has been successful. In response, Mrs. P made the following remarks:

I will have deemed myself a success if by the end of the class these kids are willing to step back at all in their lives and evaluate behaviors that they did thoughtlessly prior, and I think that for some of these people, I think that there’s been an awareness, an awakening, that’s happened, and, you know, they’re still very prone to care about what their peers think and all of that kind of thing, but I can see that in some of these kids the seed has been planted, and they can see that there are problems and that their behavior may be a part of that problem.
In this statement, Mrs. P is tying her other goal of raising student awareness to students’ willingness to examine their behaviors. While Mrs. P wants to bring students’ attention to the often negative impacts of human behavior on the environment, she is very conscious that in past years students often became frustrated if they felt powerless to act to change the environmental situations about which they were learning. Therefore, Mrs. P describes her current approach, as follows:

One of the strategies that I have been trying to develop is to not alienate [students] from me personally. I am more influential when they are on my side, and so they are not on my side when they think that they can’t do anything...and so I’ve gone out of my way this semester to try to make them feel like there’s problems out there, but there are easy things to do to deal with those problems, and that we all still want to have good lives, but we can have those good lives maybe at slightly less expense, and I’ve toned down a lot of my rhetoric a lot, believe it or not, and I think that it hasn’t pushed kids away, the way it has for some kids in the past. (Interview 2, Part 1, 4/29/09)

From this statement, Mrs. P makes it clear that she feels obligated to present students with ways that they can help the environment, going beyond presenting them with knowledge of environmental issues, but in a way that does not overwhelm them with the magnitude of the task. Interestingly, as we will see further below, a tension exists between Mrs. P’s approach to helping students see that there are “easy” actions they can take to help the environment and alienating students that may then view her as a one-sided environmentalist.

In helping students' learn to think critically about their environmentally-related behaviors, which is one of her goals for the course, I asked Mrs. P whether she takes a more explicit or implicit approach in trying to influence students to evaluate and change their behavior. She replies:

305
P: I know that I am purposefully not out there trying to work on their behavior because that is the sure-fire way to get them to do exactly the opposite, so I guess I’m implicit.
E: Right, okay, so you’re consciously not telling them like “Do this, do that.”
P: Right, I’ve done that before and it’s been a disaster.
E: Yeah, okay, and so, what did you find were the students’ reactions?
P: “Don’t tell me what to do.” I mean, right in my face...Not that I did tell them what to do. I was only hinting strongly that maybe acting differently would make for a better world. Well, you know, I was told in no uncertain terms by them, and in one case by the kid’s father, that there was no way, so I don’t do that anymore.
(Interview 2, Part 1, 4/29/09)

Although Mrs. P states that she does not use an explicit approach, or openly try to change students’ behavior, she does give an exception during her first interview (2/4/09). She states:

Except in paper conservation, paper is not an emotional issue. Saving trees is an emotional issue, but saving paper is something that makes so much sense, and the kids in the school are so aware of how wasteful the teachers are that it’s a really nifty place to say, “Alright, we’re going to act like this in this room,” and you’re going to hear me say things like, “I’m running out of paper this year. We have to save every little bit we can because I’m not going to have enough to see me through the year...” I want them to understand that by conserving you in fact create a pool of paper, and the reason that I require that they copy on both sides of the paper and that they reuse things to death is because it’s not an issue that they’re likely to get defensive about. If they feel like they can help, most kids want to help. I believe that. There’s some kids that say that they don’t care – that may be so, but I believe that most kids want to do something, as long as it’s not a real inconvenience, and then when they do the paper conservation, they see that in fact it’s not an inconvenience at all, and if that’s not an inconvenience, then it’s possible that other things aren’t an inconvenience either.

Mrs. P goes on to explain that through this type of example, she attempts to “bond the class together against the enemy that is the wasters of the world, then you don’t have to ever tell them how to behave, but they see through demonstration that you can make a change without a whole lot of change in your own lifestyle, and then it goes out there in the world.”
However, despite Mrs. P’s persistence that she generally does not explicitly try to influence students’ behavior, there is evidence from class discussions that she often does provide students with behavioral suggestions. For example, the following vignette from class (3/26/09) shows the teacher providing information that encourages students to reconsider their meat-eating behavior. The questions quoted in this vignette were student generated from a previous assignment. In this interchange, a student, Greg, is responding to some of Mrs. P’s comments:

P: Okay, let’s see, now why farmland is so needed, oh, it’s a good question, “Why does the world need to tear down rainforest in order to get farmland?”…It is the demand for meat. It is the worldwide growing demand for meat…I think we went over this when we were doing energy flow, to raise a pound of meat on a cow-
G: Twelve pounds of grain.
P: Okay, that cow has to consume twelve pounds of grazing stuff, so the cow eats twelve pounds worth of corn or silage or-, twelve pounds! So, that takes a lot of land to raise twelve pounds, and that’s only one pound of cow, that’s not the cow. That’s just one pound of that cow, so if there’s 500 pounds of meat on a cow, multiply 12 times 500 and you come up with, probably 6000 pounds of grain to produce an animal from which you are going to get 500 pounds of meat….Alright, so one of you asked, “What can we do about the problem in tropical rainforests?” How can we begin to solve that problem? So, one thing you can do, if you are a carnivore, and most Americans love their beef-, if you eat meat say twice a day, if you have a meat sandwich for lunch and meat for dinner, um, and you do that seven days a week and a lot of people do, a lot of people really eat a lot of meat. I know when I was growing up, I ate a lot of meat. Um, cut out a meat meal a week, one meat meal a week.
G: And what do I eat? Salad?
P: There’s a whole world of things to eat besides meat.

Through suggestions such as this, it could be argued that Mrs. P often crosses into the explicit side of influencing students’ behavior. It is significant, however, that she does not perceive this tendency in her interview comments because this indicates that she is not conscious of the strategies she is using to influence students’ behavior.

When asked whether it is a goal of hers to see behavior change in her students, Mrs. P replies in the following vignette that she does not expect to see immediate changes
in student behavior that go beyond the classroom. One reason is because she has no way of knowing what their behaviors are outside of class, but also because people are very reluctant to change just because they’ve heard the truth, because they’re reluctant to realize, or admit to, having heard the truth, and so it takes I think years for people to mull this stuff over and to test the ideas out in the world, and so it’s not surprising to me ever that at the end of a course people say that they are not willing to change because my experience has told me that years after they have had the course they have a realization, they see something that resonates with them. I don’t think that they forget this stuff very easily. They are going to forget a lot of the details, but the gist of it they are going to hold with them. (Interview 1, 2/4/09)

These vignettes from the interviews with Mrs. P give the impression that her immediate goals for the course are to focus upon awareness (both of environmental issues, as well as how individual behaviors are impacting the environment) and empowerment, rather than explicitly telling students how they should or should not behave. Her hope, however, is that in the long-term students will use what they have learned in class to reconsider some of their behaviors in the future. The lack of Mrs. P’s own consciousness regarding her explicit teaching of specific behaviors is discussed further in the Discussion and Implications section below.

Student Views: Teacher Influencing Their Behavior

During the second and third interviews with students, despite Mrs. P’s comments above that she did not try to explicitly influence students’ behavior, all students repeatedly agreed that Mrs. P was trying to influence their attitudes and behaviors during the course through discussions about the impacts of meat-eating, having them complete an ecological footprint, making a list of everything they own, taking them to the local landfill, and involving them in the school recycling program every week, to name a few examples. During the third interview, the students were asked directly how they felt
about a teacher trying to influence their attitudes and behaviors and if that was an appropriate role for a course in school. All students except one replied that they did not have a problem with Mrs. P’s approach, for varying reasons. One student, Kat, replies:

K: I’m okay with it because I feel the same way. If I didn’t feel the same way, I would be probably totally against it.
E: Hm, okay, because you feel like you pretty much agreed with most of what Mrs. P was saying anyway.
K: Yeah...For me, if a teacher is passionate about what they’re teaching, I tend to learn more, so it works better for me.
E: Yeah, [so] for this class you were okay with it.
K: Yeah. (Interview 3, 6/8/09)

Another student, Simon, states the following reason for his belief that this type of class has an important role within the school:

S: It’s essentially our job as students to learn and be influenced, and that’s what it does...If you have a teacher that’s really enthusiastic about the material matter and they want to teach and they want people to learn, then they’re going to influence some people, and that’s-, I think that’s ultimately what they hope for.
E: Right, yeah, and you’re okay with that as a student? With a teacher trying to influence you?
S: Well, yeah, I like learning. I think everybody does, it’s just some people don’t like school. (Interview 3, 6/12/09)

Here we see Simon equating being influenced with learning. Simon is one of the older, more mature students in the class who exhibited critical thinking skills during his interviews as he analyzed various issues being discussed in class. Following the above comment, Simon states that he realizes that he has the ability to evaluate the opinion of the teacher and make his own decisions, which is why he feels the influential nature of the class is appropriate. It seems, then, that there is an incongruity here in how the teacher thinks the students will react to an explicit attempt to influence their behavior (negatively) and how they actually respond to these attempts (positively).
In contrast to the positive views expressed above, only one student expressed wariness of the role of the Environmental Science course at influencing students’ attitudes and behaviors. A student named Rick states:

R: Well, I don’t think they should try to persuade people. I think they should just teach people like the benefits and then the consequences and stuff, like they shouldn’t try to persuade people.
E: So do it much more from like a factual, scientific approach?
R: Yeah, just let people think what they want, do what they want, but let them know what’s going to happen if they do it and what won’t happen if they do it, stuff like that. (Interview 3, 6/8/09)

From this statement, it seems that Rick would be in favor of a more content-driven approach to the class, rather than one emphasizing action. It should be noted that Rick has a negative attitude toward the class and school authority, in general, which comes across in his comments that the teacher should “just let people think what they want, do what they want.” It is important, then, for students that are wary of advice regarding specific actions that an Environmental Science teacher be aware of the tension with students that may result from this type of guidance.

Overall, however, students seemed to appreciate being taught strategies for changing their behavior, rather than simply being taught of the negative consequences. This is an important finding given that many teachers think, as Mrs. P expresses, that students will react negatively if the teacher explicitly tries to present alternative behaviors. However, there was resistance to Mrs. P’s approach at various times during the course, as we will see in the next section.

Teachers’ Goal: Presenting a Balanced Perspective

Another goal expressed by Mrs. P throughout her interviews was that of presenting a balanced point of view, and not appearing to be a radical environmentalist.
She gives the following example of what she considers a balanced presentation in the following vignette:

Okay, so for example, when we were talking about old growth in the Pacific Northwest, I felt that it was important that they understand what’s happening out there, so I presented the role of technology and, you know, the role of the owl, so on the one hand, you know everybody loves to love an owl, and to protect it and all of that, but on the other hand, the owl could end up costing people their jobs, and I said numerous times, there’s an economy at stake here, and people’s lives are going to be [affected]-, so we have to consider that maybe there’s a way to do this that doesn’t involve tearing down the whole thing, and so, you know, my goal in this-, one of my goals in this class is to get them to see that there’s a sustainable option for the way we are misbehaving on every issue, and so I think that I try to present a balanced view by emphasizing sustainability. (Interview 2 Part 2, 5/14/09)

Another example of her balanced approach is presented by Mrs. P during her first interview. In describing her curriculum for the course, she states:

Some of the case studies I have pretty cool videos that show…um, for example, when we are in our energy unit, I use the spill of the Exxon Valdez, and its impact on local fisheries, and I have two films, one that talks about the spill from Exxon’s point of view and it’s produced by Exxon, and the other one is a film produced by the people, the native Alaskans in Prince William Sound who were harmed, whose very livelihoods were taken from them as a result of the spill. (Interview 1, 2/4/09)

Both of these examples show the teacher’s conscious attempt to present multiple sides to the environmental issues being discussed in class.

Mrs. P is very cognizant, however, that despite her attempt to present a balanced point of view, the perception by her students is often that she is a “passionate environmentalist.” She believes that “these kids don’t see that you can be a passionate environmentalist advocating a middle road, which is what makes me not an extremist, but a middle of the roader” (Interview 2 Part 2, 5/14/09). Therefore, Mrs. P says that since she is aware of this, she has changed her tone in the last few years. She discusses this change in the following vignette:
I also think that kids want to identify with people who they feel are on the right side of things, and I think that they will learn better if they like their teacher, and generally kids like me, generally, but I’ve run into a problem here where they-, they perceive that they don’t agree with me because they perceive that my point of view is too extreme. I’m not able to close the deal, and so by restructuring my total approach and making it more, “Kids, we’re in this together” kind of thing, “We got to look at what these guys are doing, and we’re in this together.” Um, I think that they can still like me and they can still think that they can bond with me on some level without it being too much of an abrogation of their own value system. (Interview 2, Part 1, 4/29/09)

Here Mrs. P is expressing how her own consciousness of students’ reaction to her opinions has caused her to tone down her rhetoric in recent years in order to connect with more students.

During her third interview, as Mrs. P attempts to present a more balanced view of the issues to students, she comments that showing two dramatically different sides to an issue, I think always works with them... One of the important things for me in teaching the course was in getting them to understand that there’s always two sides to every one of those issues, and that even though I tell them what my bias is, all I want to do is show me that they can make a good argument, whatever side they take, just make a good argument. (Interview 3, Part 1, 6/25/09)

In response to this comment, where Mrs. P is advocating for her approach to teaching multiple sides of an environmental issue, I ask her if she perceives that this is at all confusing for students who may not know which side is “correct.” She replies, as follows:

Yes, of course it does [confuse them]. On the one hand they want to be told what to think cause it’s easier, and because most of those kids are really lazy. They would rather just be, “Just tell me what you want me to think here,” but of course I don’t want to do that, and the same thing happened at [the university]. Kids got really angry with me because I wouldn’t tell them what to think, and then by the end of the course they understood that it was better to actually think through how you think. So, I’m okay with them being confused. I think that with this material almost more than any other material that they take throughout their whole high school career, I think that the weight of it, the importance of it is manifest down the road. They have to go out and live a little bit and see how this material fits into what their experience of life is, and I think that critical thinking skills take a really long time to develop, and I know that they’re not going to become critical
thinkers at the age of 16 or 17, but I feel like I ought to-, I have a responsibility to try to push them that way, even though they might be confused by it. (Interview 3, Part 1, 6/25/09)

Overall, then, we see Mrs. P’s approach is to try to present students with multiple sides of each environmental topic discussed in class, with the hope that students will not perceive her as an extreme environmentalist and will be able to use their critical thinking skills to assess where they stand on each of the issues.

**Student Thoughts: Presenting a Balanced Perspective**

Throughout the semester, students’ opinions about the teacher, the source of information during class discussions, changed as the class moved from topic to topic. At the beginning of the semester, most students reported liking the Socratic dialogue format utilized by the teacher and felt that it created an open forum for discussion. For example, during his first interview (2/19/09), C.P. says:

> I like the fact that Mrs. P will introduce a topic, and she won’t necessarily have us do an assignment on it, but she’ll have us, you know, debate it, essentially, and she’ll call on everybody...Like letting kids to draw their own conclusions, letting them figure it out rather than just, you know, giving them a test and having them memorize it until they take the test and then forget it. It just seems like they’ll retain it more, and that’s one of the things I like.

Towards the middle of the semester, however, when issues got more controversial over the subjects of logging and then the agricultural industry, students felt that the teacher became less open in listening to students’ opinions that contrasted with her own. They voiced frustration during interviews and cogenerative dialogues during this period. For example, the following vignette is taken from Kat’s second interview (4/8/09), when asked her opinion of Mrs. P:

> K: She’s a very nice lady and she’s an okay teacher. She just needs to watch what she says, and put more thought into it. I mean she puts lots of thought into it. She just doesn’t put thought into how people are going to react to it.
E: Hm, okay, do you have an example there?
K: Like the whole opinion thing. I mean, C.P. tried to argue his opinion, but she was all like, “No, you’re wrong, end of story,” so she might want to think of how other people might feel.
E: Yeah, okay, so that’s interesting because at the beginning several people I interviewed, I think you did too, said that it seemed like it was a very open environment, and people could say whatever they wanted.
K: It is a very open environment, and you can say whatever you want. You just have to be careful because if it’s against what Ms. P thinks, then there’s going to be a fight.

Another student, Barrett, expresses a similar sentiment during his second interview (4/9/09), when asked his opinion of the class thus far:

B: I don’t know. I think it’s kind of opinionated a little bit. I don’t like that...It seems like it’s kind of like all Ms. P’s opinion, like “You should do this, you shouldn’t do that.” I guess most of it is true, but at the same time it’s her opinion.
E: M-hm, so how do you think she could present it differently? Would you prefer if it was a little more balanced?
B: Mm, yeah, like a little bit more her listening to our views a little bit more.

In utilizing Heise’s affect control theory to interpret these comments, it is evident that students are responding negatively when their expectations of the teacher as a “balanced” provider of information are not reflected in the teacher’s actions. Again, here is another example where the teacher’s intention, in this case presenting a balanced perspective on the issues, was not perceived as such by several of the students during the middle portion of the semester.

In contrast, however, other students thought that throughout the semester Mrs. P was able to present the issues in a balanced manner, thereby exhibiting overlap between their expectations and Mrs. P’s discussion of the environmental topics. For example, the following vignette demonstrates Allan’s perception of a balanced presentation:

I actually think she presents it both ways because when we were talking about the logging, she doesn’t like the fact that the logging is going down [as in “happening”], but she’s not so far on that side to not understand that people’s jobs
are going to be lost if we just stop logging altogether, so she presented the fact that we’re losing all these resources, but we need that resource too, to build houses, to build other things that we need. (Interview 2, 4/15/09)

By the end of the semester, after she showed videos presenting both sides of the Exxon Valdez oil spill issue (from the viewpoint of Exxon scientists, and then the residents of Homer, Alaska), and had the Alaska National Wildlife Refuge debate where students debated the pros and cons of opening the refuge to oil drilling, almost all students agreed that she adequately portrayed a balanced perspective. In this next section, a student named Greg describes his view of Mrs. P as an avid environmentalist, and yet he perceives that the class was taught in a balanced way. Regarding Mrs. P, he states:

She’s an environmentalist, you know, she’s not in the middle, but she’d rather, you know, save the environment then do something else with it. I mean, but there’s nothing wrong with that. I mean, that’s just how it is. That’s pretty much what the environmental class is… but she doesn’t go to the point where it’s like beating it into your brain that “You need to do this. This is really bad. Oh, this is aw-” you know, she’s not Earth First, you know. She’s in closer to the middle, so-

(Interview 3, 6/3/09)

When asked if he thought the class was presented from a one-sided or balanced perspective, Greg continues,

G: I mean it was a pretty balanced class. I mean, it was a really good-, it was a fun class. I’m glad I got to take it. I think it’s well balanced.
E: It presented enough of the sides that you can sort of decide for yourself.
G: Yeah, you can-, cause you know, like the debate we did today, you know, you’re either for or against it. We did both sides type thing, and being on either side, you know, it all comes down ultimately to what you think, so- (Interview 3, 6/3/09)

Another student, C.P. states that if Mrs. P had been more one-sided, “then I would have had a problem with it, but she was fairly-, I mean, yeah, she was biased, but even so, she was fairly even-handed in the treatment of the subject matter, so-” (Interview 3, 6/4/09) and he adds that this had a lot to do with his accepting the influential nature of the class.
These findings signify that students seem to have the expectation that an Environmental Science teacher will be an environmentalist on some level, but also have the expectation that the teacher will attempt to present the issues in a balanced manner. From the student comments, it is evident that they respond positively when their expectations are met, and are negatively affected when there is a mismatch between their expectations and their actual experiences in the classroom.

Teacher’s Goals: Critical Thinking and Evoking Emotion

Mrs. P discusses throughout her interviews the importance of both encouraging critical thinking in her students, as well as appealing to their emotions, often in the larger context of bringing about behavior change. When asked if she emphasizes either critical thinking or appealing to students’ emotions in her first interview, she replies:

Yeah, all those things. Well, it depends on what the activity is. Um, the Exxon Valdez thing is an opportunity to do excellent critical thinking. Um, critical thinking skills are really important to me...because I think that if you can critically think than you can think, and so, when they learn about old growth forests they are going to see some things that will shock them, and some of them will get really angry about the way Earth First! operates out there and it will appeal to their emotions. (Interview 1, 2/4/09)

Regarding the relation between the elements of critical thinking and evoking emotions,

Mrs. P comments:

I think that their response at the age of 16, 17, 18 years old is to act really viscerally towards this stuff, and then, when knowledge and facts and stuff begin to work their way into their consciousness, then they’re able to more critically think and they become less emotional about it. The trick is this - I want them to be emotional about this stuff. I think that the culture here does not encourage a lot of emotionality, if that’s a word, and I try to encourage them to feel safe enough in the room that they can feel emotional about something and that that’s often times a good response to certain situations...Sometimes when people begin to critically think, the emotion, the emotional aspect of it gets depressed a little bit, and they get a lot in their head and the compassion part of this, that I think is so important, that compels people to want to change their behavior or compels people to want to talk to other friends about the importance of being a certain way, you know, that’s
driven I think by something, as [a professor] always used to tell me, “It’s the fire in the belly” kind of thing, and that’s an emotionally driven thing…but you’ve got to have the facts to back you up, so, you know, those two things have to go along in tandem, and it’s really a trick depending upon where the class is at any point of time. (Interview 1, 2/4/09)

Here Mrs. P is describing the interrelated nature of critical thinking and emotion as students react to the information learned during class. During her second interview, I asked Mrs. P what she thought determines which students are influenced by the class and which are not. Her answer again involves issues of critical thinking and compassion, combined with receptivity to learning new information, as follows:

Well, I think their receptivity. I mean if they’re receptive to learning and if they have an open mind. Um, I think that some students are driven by a good argument, and so I try to appeal to these kids on a lot of different levels…So, you know, people who are capable of higher-order thinking, and there are a few of them in that class, I look at their faces and they’re listening to me really, really intently, and I know if I’ve scored with them. I know these kids well enough to know on what level I can appeal to them, and what will always win me something. So, with some of these kids, compassion will never work. A good argument will, and others compassion will always win the day…So the thing that motivates Kat, for example, is compassion. She wants to be a social worker and take care of people, and the more screwed up somebody is, the more she wants to take care of that person, you know, but that wouldn’t motivate Allen in the least. He’s interested in knowing why, whereas that, I think that counts less for Kat, although she wants to know that she’s doing the right thing, and she wants to know why it’s the right thing. (Interview 2, Part 1, 4/29/09)

During the second part of this interview, Mrs. P makes it clear that she feels presenting students with knowledge is often not enough to compel them to action. It is often the emotional component that drives them to act on this knowledge. Mrs. P states:

In the end, I think that it matters that they act with conscience because they understand something they didn’t understand before, so whether their compassion is driving them, if it’s compassion, that’s more powerful than anything else, I think, because that compassion will bleed in a million different directions…If they’re developing a conscience about doing the right thing that’s incredibly powerful, and so, you know, that I think would be more important than having them make the connection to “Well, if I don’t screw up, then the world will be a better place for people” because I think that making that leap is really hard

317
because what can one person do-, you’ve got this whole world of 6.7 billion people acting out there, and so if they are acting out of the intellectual side of their brains, then they could think themselves completely out of acting at all, but if they act from their heart because they know on a certain ethical level it’s the right thing to do, then I will have succeeded, because that’s more compelling. (Interview 2, Part 2, 5/14/09)

Evidently, then, Mrs. P sees an important role for both critical thinking and eliciting emotion within the Environmental Science course. It is important to note, however, that while Mrs. P clearly separates these goals, the relation between cognition and emotion remains highly debatable in the fields of moral psychology (Hauser, 2006; Nichols, 2002) and neuroscience (Taylor, 2001). From this last vignette, it seems that one of Mrs. P’s implicit strategies in motivating students to act in more environmentally-friendly ways is to appeal to them on an emotional level during her presentation of the various issues throughout the course.

Students’ Critical Thinking and Emotional Reactions

Throughout the Environmental Science course, Mrs. P gave students assignments, showed them videos, and led discussions which were designed to evoke emotion, sometimes anger or frustration, and other times compassion, as well as encourage students’ critical thinking. Sometimes the students’ response came in the form of a personal struggle with a particular issue. For example, during his second interview (5/4/09), Rick is clearly struggling to define his beliefs regarding the issue of logging currently being discussed in class. He states:

Well, seeing how the loggers like, they just cut down so many trees, and I feel like loggers have to do their jobs, but seeing them [the trees] after they do their jobs-, seeing the job after they’re done just like-, it’s kind of hard to look at that and be like, “Well, there was trees there, but now there’s not” but I still believe that the loggers have to do that to stimulate the economy and stuff.
In this vignette, we not only see Rick contemplating multiple perspectives regarding logging, it is clear that his feeling of connection with the environment is bringing his emotions into his consideration of the issue as well. Another example of the overlap between critical thinking and students' emotions is evident in students’ responses after seeing a film about India’s population growth and the status of women, an issue of which many students in the class were unaware before seeing the film. One of the most passionate responses to a video is from a student named Mariah, who comments:

M: I didn’t know that India had so much population growth. I knew that they disrespected women over there, but...seriously, they need to get some new laws. Honestly, I wouldn’t stand for that. If someone like mentally or physically abused me, I’d abuse back, cause- It’s just crazy.
E: Yeah, but how did that make you feel when you saw that movie?
M: Angry. Very angry, I was tearing at my paper like this.
E: Yeah, but who did you feel angry towards?
M: Um, the country itself, because if the country didn’t have those laws-, well, it isn’t exactly laws, but standards stating that women were lower, when we’re actually equal...is just infuriating, and any person who thinks that they should treat another human being so horribly, I think they need to be shot. (Interview 1, 2/18/09)

Here we see the “fire in the belly” type visceral reaction that Mrs. P aimed to evoke in her students, in addition to exhibition of the character trait of “intellectual empathy,” or the ability to put oneself in the place of others to consider their viewpoint (Paul & Elder, 2001). All three of the female students who were interviewed reported feelings of shock and horror at seeing the lives of girls their age. In another example, Payton expresses her feelings after seeing the movie, which she ranked the number one most influential activity for her:

That really was like, “Oh my goodness. We have tons of people.” Then what it makes me think of is the size of Danville, and how many residents we have in Danville, and how tiny Danville is in [this state], and then all the other states we have compared to that, like we have so many people that live in America, like that’s crazy, and how in India we see them searching through the trash and like all
of that, and that movie was very like, “Wow.” It made me like step back, and kind of like not be selfish for a couple minutes, and be like, “Wow. Look at those people searching through the trash. I feel bad.” (Interview 3, 6/1/09)

Clearly, this movie had a significant impact on Payton, since she is discussing it almost four months after seeing it. It seems to have made her reflect upon her own values as her consumer-materialist identity is disconfirmed, and Payton begins to change her decision-making regarding the purchasing of material items that she does not need, as we will see below.

One of the few homework assignments during the semester was for students to create a list of everything they own, which had a significant emotional impact on at least two of the student interviewees, again through a disconfirmation of their consumer-materialist identity. For example, when Allan was asked during his second interview (4/15/09) if he’s done anything in class that has made him care more about the environment, he responds:

A: Probably the thing that made me care the most about the environment would be when we were doing population and Ms. P had us write the list of everything that we had, and then just seeing how much stuff we actually have. Even if we didn’t do a complete list-, I didn’t write down everything that I had, but the things that I did write down, I had a full page, so it’s like, that’s a lot of stuff. For her to say, other people in other countries don’t have like an eighth of that, so it’s just ridiculous.
E: Yeah, so how did that make you feel?
A: Like we use a lot of our resources to get stuff that we don’t necessarily need to survive. They’re not necessities; they’re things that we want, so-
E: Right, did that make you feel bad personally?
A: Yeah.
E: Like in terms of your own lifestyle?
A: Yeah.

From this response, it is evident that this activity emotionally affected Allan as he came to a realization about the materialistic tendencies in his own lifestyle. The extent to which he extended these feelings to critically reflect on his own behavior remains unclear.
Payton, who was quoted above, describes taking this experience to another level, where she exhibits “intellectual courage” (Paul & Elder, 2001) in critically reflecting upon her own values, and it begins to affect her behavior. When asked during her third interview (6/11/09) about the most influential activities in the class, she responds:

P: The other thing was the inventory that she made us write down everything we have. I was like, “Oh my god. I have so much stuff” cause I actually like sit there and wrote and wrote and wrote, like everything, and I got to the point at the end where I was just like estimating cause I was like, “400 pony tails.” I was like, “Oh my goodness.” I was like, “I have so much stuff. It’s ridiculous.” It is really ridiculous how much stuff Americans have, like I don’t know why we produce so much when we don’t need it.
E: Right, so did any of those actually have an effect on things you do in your life?
P: Yeah, I don’t buy things that I don’t need really now, or like want really, really, really bad. If I’m just walking through Walmart and I’m like, “Oh, I could use some new pony tails.” I’m like, “Oh, but I have 400 at home” so I don’t buy them, like I think about it.
E: Oh, okay, so you’re thinking twice before you buy stuff.
P: Yeah, I think twice before I buy stuff, and it costs money to buy stuff and I don’t have money. I’m a teenager. Things are expensive.

Here we see a process during which a student emotionally responds to an activity while engaging in critical reflection, which ultimately affects her decision-making and behavior. It is difficult to separate the emotion from the reflection, as they seem to be occurring simultaneously in Payton’s recalling of the event. Another behavioral change that comes as a result of both an emotional response and critical reflection is seen in the following vignette, where in C.P.’s third interview (6/4/09) he attributes his decision to reduce his meat-eating to activities in class:

E: M-hm, yeah, and, um, so how did the PETA movie affect you?
C: I was kind of like disgusted by like what goes on in there, and I have been like cutting down on meat that I eat.
E: M-hm, yeah, as a direct result of seeing that?
C: Yeah.
E: Huh, okay, so that really struck you pretty harshly.
C: M-hm, I mean I still eat meat, but, you know, I like, I try to eat less, so like instead of bringing a roast beef sandwich, I’ll have, you know, P.B. and J.
E: M-hm, m-hm, yeah, that’s a really big step, C.P., for you cause you’re a pretty big meat eater, and was there anything else that kind of influenced you to do that, to start eating less meat?
C: Like some of the stuff Ms. P talked about, about how like, you know, they have to like cut down the rainforest and then they put in pasture land for the cows and stuff, and then like the King Corn thing, there was some influential [things] in that.

This vignette demonstrates that C.P.’s response was both emotional as he reacted to the movie, as well as cognitive as he considers the arguments he heard in class from the teacher. While C.P. already had a strong environmental background coming into the class, he says that overall, the class has “cemented” his environmental views (Interview 2, 4/7/09), and caused him to feel more strongly on certain issues. For example, when asked whether he agreed or disagreed with the statement, “The so-called “ecological crisis” facing humankind has been greatly exaggerated” C.P. replies:

C: I disagree because I mean, we are in danger cause we’re wiping out species by the dozen, you know, and, any one of those could-, we’re polluting, we’re filling up our planet with trash, we’re, you know, punching holes in the ozone layer, we’re, you know, heating up the planet.
E: Uh-huh, yeah, okay, so you don’t think that-
C: Don’t give me any of this “so-called crisis” B.S.! Don’t give me any of that “there is no global warming.” Yeah, shut up.
E: Does that make you angry?
C: Yes, it does.
E: Okay, so you, you would say you strongly disagree with that statement.
C: Yes, I strongly disagree with that.

C.P’s emotional response here demonstrates that he is feeling more strongly about environmental issues as a result of the class. From the vignettes of C.P. and the other students, we see that throughout the course students experienced emotional responses to various activities and discussions and engaged in various levels of critical reflection, and at least three (only two are presented here) were compelled to change their own behavior as a result. While evoking students’ emotions seems to have the desired effect here from
the teacher’s perspective, we will further consider the role of emotion and critical thinking in the objectives for the Environmental Science class in the Discussion and Implications section below.

**Discussion and Implications**

With the increase in the number of high schools offering an Environmental Science course in recent years (Edelson, 2007), and the lack of standards at the national or state level establishing objectives for the course, this investigation is an attempt to bring to the forefront several important issues facing Environmental Science teachers as they develop their goals for the Environmental Science course. A sociocultural approach is utilized in this study to highlight the importance of cultural influences and social relations as factors contributing to the teacher’s decision-making, as well as students’ responses to their experiences in the class. Examples of cultural influences included students’ expectations of the “teacher role,” in addition to the influence of students’ environmental and consumer-materialist identities, which often have cultural underpinnings, while social interactions are a continual influence upon the enactment of all the goals, as each involves communications between the members of the class. Throughout Mrs. P’s comments in the interviews cited above, it is clear that her objectives were not formed in a vacuum, but rather have been formed from years of teaching experience and interactions with her students. For example, from her experiences with this particular population of students, Mrs. P has formulated goals for the course in an attempt to balance her own values as an avid environmentalist with the understanding that her students come from a range of environmental backgrounds. The strong educational background of Mrs. P also has given her a sense of the importance of
knowledge, specifically scientific knowledge, which may not be a prominent value for her students in this lower level course, the majority of whom state that their main goal for the course is simply to pass. Mrs. P’s attempts to stress the importance of “knowledge as power” throughout the semester represent her effort to convince students that knowledge of environmental issues is important for them. Additionally, from her comments it is evident that Mrs. P takes into consideration the socioeconomic situation of her students, often from low income families, in establishing student empowerment as one of her primary goals for the course.

In the teacher’s interviews, she emphasizes that while one of her main goals is to raise the awareness of students in terms of both environmental issues, as well as awareness of the impacts of their own environmentally-related behaviors, she feels that the class should go beyond raising awareness into the realm of empowerment. From the student comments during their first interview, it becomes evident that many students were lacking the self-efficacy necessary to feel that they could individually make a difference in helping the environment, not necessarily as a result of their socioeconomic situation, but because of their position as teenagers living at home. Without an empowerment objective, students may be left feeling negative and helpless as a result of their increased awareness, as we saw after students completed the ecological footprint activity. Other students, such as Barrett, expressed an overall lack of confidence that any of their individual actions would make a difference or have any real impact on environmental problems. Unfortunately, this may be a common sentiment among the general population; however, the Environmental Science course presents an opportunity to address this concern for students. In order for this to occur, it is important for teachers
to not only raise students’ awareness of how they themselves may be affecting the environment negatively, but to couple this information with knowledge of how they can take action to help the situation. It may also be necessary to directly involve students in a group activity, such as a school-wide recycling program, to help show students how their collective actions can be impactful at the community level.

Additionally, the development of environmental identity as described by Kempton and Holland includes three stages, only the first of which is raised environmental awareness leading to increased salience of one’s environmental identity. The other two stages involve empowerment and taking action on a community level. It has been shown that active environmentalists have gone through all three of these stages of development, although not in a specific order (Kempton & Holland, 2003). We must consider, then, if we are satisfied with aiming the Environmental Science course towards only the first of these stages. However, we must also take into account Edelson’s (2007) warning that including advocacy within the Environmental Science curriculum may be at odds with certain political and social values of families within our schools. Along these lines, it was observed that if a teacher is too aggressive in pushing her own environmental agenda onto her students, she risks alienating a group of students with a different set of values. There were two approaches utilized by Mrs. P in this classroom in order to minimize this possibility, including presenting multiple sides of the various environmental issues discussed in class, as well as reducing her explicit encouragement of specific behavior changes. However, it could be argued from the student reactions, as well as Mrs. P’s assignments and discussions, that there were times at which she more effectively utilized these strategies than others. This represents a discrepancy between the teacher’s goals
and teaching practice, as she seemed largely unaware of the extent to which she explicitly tried to influence students’ behavior and that she was largely perceived by the students as being rather one-sided during the middle portion of the semester. An incongruity between teachers' goals and classroom practice has been noted in areas such as developing students' critical thinking and teacher's assessment strategies (Bol & Strage, 1996; Fischer-Mueller & Zeidler, 2002), but has not been previously studied regarding the goals of balanced issue presentation and environmental behavior. This finding confirms the importance of helping teachers to be more conscious of how their teaching strategies are being perceived by their students as they assess whether their teaching goals are being achieved.

Interestingly, Mrs. P expressed a keen awareness of how her students would react if they viewed her as being too biased in her presentation of the issues. Using Heise’s terminology from the affect theory of emotion (Turner & Stets, 2005), she accurately understood the fundamental sentiments of the students in their expectations of the “teacher role.” Even students that had a strong environmental background coming into the course, such as Kat and C.P., were conscious of whether Mrs. P was presenting only the environmentalist perspective, or was including other social and economic perspectives as well. Although she attempted to meet those expectations, at times the transient impressions of the students varied from what was expected. For example, we see the students towards the middle of the semester expressing frustration that the teacher is too one-sided and not listening to the opinions of students in the class. By the end of the semester, however, Mrs. P included activities that presented the issues in a more balanced manner resulting in more positive impressions of her by the students. It
therefore seems that the alignment of students’ transient impressions with their fundamental sentiments regarding the balanced nature of the course was one of the most important determinants in their overall opinion of the course.

Notably, the students were accepting of the influential nature of the Environmental Science course upon their environmental attitudes and behaviors, as long as they perceived that the teacher was presenting multiple sides of the issues. This marked a discrepancy between what Mrs. P thought were the fundamental sentiments of the students (i.e., that they would not be accepting of explicit teaching of pro-environmental behavior alternatives), and the actual expectations of the students. These expectations seemed to reflect the perception that in signing up for an Environmental Science course, there was an underlying assumption that the class may attempt to influence their attitudes or behavior. The one exception to accepting the persuasive nature of the course was the student, Rick, whose relationship was very tense with Mrs. P when he felt that the teacher’s opinions regarding the environmental issues as well as environmentally-related behavior were expressed too strongly. Therefore, it seems that the teacher’s understanding of the fundamental sentiments of the students is critical in determining the most effective goals and manner of implementing those goals.

As we consider the connection between the teacher’s goals and the curriculum, it is evident that Mrs. P intentionally included several assignments and discussion topics in the course that would affect students emotionally. Using the language of Stryker’s identity theory of emotion (Stryker, 2004), Mrs. P was attempting to strengthen students’ environmental identity through evoking such emotions as compassion, as well as encouraging the disconfirmation of student’s consumer-materialist identity through
activities such as the ecological footprint, creating a list of everything they own, and the documentary regarding the status of women in India. In the final results section above, we see that indeed many students were emotionally affected by various activities during the class, in some cases directly affecting the behaviors of students when their identities were disconfirmed. While Mrs. P also encourages critical thinking amongst the students, often through showing videos representing different sides of an issue, and then through Socratic dialogue during classroom discussions and debate, she views the emotional response of students as more powerful than students thinking through an issue. The students’ comments in the results indicate that it is often their emotional response that is most immediate. It is less clear, however, how this response interacts with their willingness and capability to critically think about or reflect upon the new information and how it fits in with their values and behavior, as this willingness and/or capability seems quite variable from student to student and topic to topic. Ultimately, it seems to be a combination of both the students’ emotional reaction to an experience and their critical reflection upon that experience that determines whether a student will consider changing her environmental attitudes or behaviors. More research is needed to further investigate this relationship; however, it should be noted that while critical thinking is often listed as a reform objective (American Association for the Advancement of Science, 1993; Fischer-Mueller & Zeidler, 2002; National Research Council, 1996; Onosko, 1989; Onosko & Newmann, 1994), attention is rarely paid to the importance of students’ emotional responses to activities in the science classroom. The findings of this research suggest, however, that emotion has an important relationship with critical reflection during the students’ experiences in the class. If so, this means that if our goal is to
encourage students’ to reflect upon their values, then emotion cannot be ignored. As we consider different approaches to the teaching of the Environmental Science course, this raises a provocative question about whether the role of the class is simply to inform students about environmental issues, or whether it is the role of the class to bring about change (through critical thinking and evoking emotion) in students’ environmental attitudes and environmentally-related behaviors.

Although this teacher did not emphasize developing students’ emotional connection with nature as one of her goals for the course, it is important to consider whether incorporating outdoor activities should be a part of the Environmental Science course if we want students to develop a connection to their local environment. Studies that have looked at the development of environmental identity in environmental activists show that they generally have had positive experiences in nature as a child that they describe as meaningful (Clayton, 2003; Kals et al., 1999; Kaplan & Kaplan, 1989). Additionally, arguments have been made from Dewey to Louv regarding the importance of incorporating nature experiences within the formal school curriculum. Dewey in an essay entitled “The School and Social Progress” said the following:

We cannot overlook the importance for educational purposes of the close and intimate acquaintance got with nature at first-hand, with real things and materials, with the actual processes of their manipulation, and the knowledge of their special necessities and uses. In all this there (is) continual training of observation, of ingenuity, constructive imagination, of logical thought, and of the sense of reality acquired though firsthand contact with actualities. (cited in Orr, 1992).

More recently, in *Last Child in the Woods* (2005), Richard Louv makes the argument that young people need to spend time in nature for psychological and emotional health. Interestingly, Louv also refers to a report called “Closing the Achievement Gap” by the State Education and Environmental Roundtable, a national effort studying environment-
based education, which shows that "environment-based education produces student gains in social studies, science, language arts, and math; improves standardized test scores and grade-point averages; and develops skills in problem-solving, critical thinking, and decision-making" (p. 204). Another study conducted by Wells and Evans at the New York State College of Human Ecology at Cornell found that young children with more nature near their homes have lower levels of behavior conduct disorders, anxiety, and depression, in addition to rating themselves higher on a global measure of self-worth (cited in Louv, 2005). For various reasons, then, including identity development, emotional health, conservation behavior, and improved student outcomes, these studies all point to the conclusion that students can benefit in multiple ways from spending time outdoors. The majority of the research, however, relating environmental-based education to outcomes in school or other psychological measures have been conducted with younger children; therefore, more research needs to be conducted with the adolescent population to evaluate if time spent outdoors has the same positive impact on older students.

During the semester in which this research project took place, the students spent two days outdoors as part of the Environmental Science course. From their responses, these two days did seem to make a significant impression on the students. After the second day spent outside, when asked how the time spent outdoors during class affected her, Payton remarked during her third interview (6/11/09): "I saw a lady slipper the other day, and I actually stopped and really looked at it for the first time like ever. I actually was like, 'Oh, that's a lady slipper' and then I actually went and I looked at it, and I was like, 'Oh, it's pretty.'" Two other students remarked that going outside to see the trees
helped augment their learning about the local environment. For example, Juan comments during his second interview (4/16/09): “I’m a more hands-on person, so she brought us out to the Pines, you know, she showed us this is what’s happening, not just saying this is what’s happening in the textbook.” Kat says similarly: “I liked being outside. I liked being able to see what we were talking about, like she’s all like, “Blah, blah, blah, trees, trees, trees” and then I could just look at the tree, and be like, “I see it” (Interview 2, 4/8/09). While these statements give the impression that going outside was a positive learning experience for these students, further research should be conducted to explore in greater depth the effects on students’ environmental identity and behavior as a result of spending a greater amount of time outdoors during an Environmental Science course.

As Environmental Science teachers proceed with the task of designing the curriculum for the Environmental Science course, this study has revealed several factors that create a new way of conceiving of the goals of the course. While the Belgrade Charter (1976) focuses the environmental education community on the goals of environmental knowledge, skills, attitudes, and behavior, this study provides more depth of understanding in how to realistically achieve these goals, and in suggesting other goals that perhaps deserve more attention. For example, the findings have revealed the importance of presenting environmental issues in a balanced manner in order to meet students’ expectations of the “teacher role.” As this course was focused on an interdisciplinary presentation of the issues, this factor proved very important in the way students reacted to the course. It is unclear, however, in a course which presented the issues from a solely factual, scientific standpoint, whether this finding would be significant or not.
The study results also indicate the importance of not only emphasizing critical thinking skills as students contemplate the environmental issues and how they intersect with their own values, but also the importance of monitoring students' emotional responses to the activities in the class. Paying attention to how students are responding emotionally to various experiences can help the teacher to identify ways in which students' identities are being affirmed or disconfirmed, as well as how students are perceiving the enactment of the goals for the course. For example, students' negative feelings about themselves after completing the ecological footprint were an indication to the teacher that students were in need of learning more direct ways they could take action to help the environment. This example also demonstrates the importance of establishing student empowerment as an objective for the Environmental Science class. The findings suggest that consideration should be given to expanding science and environmental education guidelines to include empowerment objectives, if we want students to leave the course feeling positive about their ability to make a difference. This suggestion is in line with the findings of the studies which have shown a positive correlation between self-efficacy or internal locus of control and pro-environmental behavior (Meinhold & Malkus, 2005; Hwang et al., 2000).

A final significant finding of this research was that students did not negatively react to the teacher trying to influence their attitudes and behaviors, as long as they perceived that the class was being taught in a balanced manner, as noted above. It seemed from the student responses that they had an expectation when they signed up for an Environmental Science course that it would in some way be attempting to influence them. This suggests that teachers' beliefs that they cannot explicitly teach environmentally-
friendly behaviors may not be accurate if combined with other teaching strategies. Again, more research is needed in other classrooms to investigate if this finding holds true with different populations of students. Overall, the study results seem to indicate that if the teacher's goals are in line with students' expectations for the course, then it is more likely that those goals will be achieved. This result should be seen as a hypothesis which will require testing and analysis in future studies.

While this study raises several important questions regarding the objectives for the high school Environmental Science course, the results are focused on the teacher and students in one classroom. Although the results show the depth of thought and emotion experienced by the teacher and students during this class, it will be important to study other Environmental Science courses as well in order to compare the effectiveness of various teaching approaches. Future studies comparing the impact of a more science-based environmental course on students with a more interdisciplinary, advocacy-based approach may provide insight into how students are affected by these different strategies. Additionally, studies conducted with a more culturally diverse student population would be informative regarding similarities and differences amongst different populations of high school students. As we move forward in this era of increasing environmental attentiveness, we must continue to reflect upon the role that the Environmental Science course should play in our efforts to create an informed citizenry that will act in an environmentally-responsible manner. This investigation is an attempt to bring several issues to the surface regarding the objectives we hope to accomplish in teaching about the
environment. By contributing to the discussion on this topic, it is my hope that educators will appreciate the possibilities of what can be achieved through the Environmental Science course and that this will be built upon in the future.
CHAPTER 6

THE SYNTHESIS

The intention of this research project was to search beyond the categories of environmental knowledge, skills, attitudes, and behavior in order to discover in depth what the experience of environmental learning is like for students in an Environmental Science course. By utilizing a sociocultural approach to explore the process of change in students' environmental identity and pro-environmental behaviors, this allowed for an exploration of the influence of students' background, relationships, and cultural pressures on students in the Environmental Science classroom. The focus on one teacher and her 17 students led to a meaningful set of findings revealing their experiences with the goals, curriculum, and the activities in the course, which should be informative for other educators working with students to help them define their relationship with the environment.

This chapter represents a synthesis of the major themes and implications presented in the results chapters. The sections below are developed around the themes of the role of environmental identity, emotion, empowerment, presenting a balanced approach, behavior change, and cultural tension in the Environmental Science classroom. The goal is to bring together and make connections between the conceptual framework and the findings presented in all three results chapters. Throughout this chapter, particular focus is placed upon inclusion of specific recommendations for both researchers and
educators in interpreting and utilizing the findings from this dissertation project, in addition to suggesting areas where future research is needed to expand on this study’s results. The conclusion of this chapter includes a summary of the importance and limitations of the study’s findings for the broader science and environmental education research communities.

**The Role of Environmental Identity**

"A sense of connection to some part of the nonhuman natural environment, based on history, emotional attachment, and/or similarity, that affects the ways in which we perceive and act towards the world; a belief that the environment is important to us and an important part of who we are." (Clayton, 2003, p. 46)

Clayton and Opotow’s book, *Identity and the Natural Environment: The Psychological Significance of Nature* (2003), has provided a framework of research on environmental identity, which has been useful in the interpretation of the data generated from this dissertation research. In addition, Kempton and Holland’s (2003) theory of the development of environmental identity through the three stages of salience, empowerment, and activism was especially helpful as a guide in understanding the environmental identity of the students in the class, and how this identity changed during the semester. These stages were also useful in establishing a definition of “substantial” change in environmental identity for the students in this Environmental Science classroom. The student interviews uncovered the environmental background of the students and the differing types of prior experiences that the students had with environmental issues, actions, and time spent in natural areas. These varying experiences led to different levels of salience of the students’ environmental identity at the start of the semester, and although some performed pro-environmental behaviors, none of the student interviewees had reached the level of environmental activist before entering the class.
During the analysis phase of the dissertation, student after student interview revealed different mechanisms the students were using when their values, a key part of their identity, were being challenged by activities in the class. Students were expressing distressed emotions regarding the ecological footprint activity or the films shown in class, and then choosing to either ignore this information, twist it to fit their own beliefs, or accept it and make changes in their own lifestyle. It became clear that the class was affecting each student in a personal way, at the level of his or her identity. Both Stryker’s (2004) and McCall and Simmons’s (1978) identity theories of emotion tied together the key interaction between identity and emotion that the data revealed, while the chapters in Clayton and Opotow’s *Identity and the Natural Environment: The Psychological Significance of Nature* (2003) provided the backbone of research on environmental identity around which identity theory of emotion could be applied. Stryker’s theory explains that when an aspect of one’s identity is affirmed, it is strengthened and increases in salience, whereas disconfirmation of one’s identity leads to negative emotions and reassessment of that aspect of one’s identity. Hitlin (2003) states that an individual’s values, defined by Schwartz (1994) as "desirable transsituational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity" (cited in Hitlin, 2003, p. 119), in this case either environmental or materialist, are questioned or strengthened along with one’s situational identities. Therefore, this suggests that appropriation of new values may lead to a change in one’s associated situational identities. As an individual attempts to placate the negative emotions associated with identity disconfirmation, McCall and Simmons (1978) inform us that the possible responses include (1) “short-term credit” where a particular episode of
nonsupport for an identity is essentially ignored as a one-time event; (2) "selective perception" so that elements of a situation are given selective attention thereby affirming one's identity; (3) "selective interpretation" in which elements are accurately perceived, but interpreted allowing for identity affirmation; (4) withdraw from the interaction or situation that is disconfirming the identity; (5) switch to a new identity that is more easily confirmed, and (6) "scapegoat the audience" faulting others for the disconfirmation process. These responses to identity disconfirmation were used within the study context to characterize students' responses when their values, or fundamental elements of their identity, were challenged during the Environmental Science class.

This framework allowed for the development of a story for each of the student interviewees as their own environmental identity was revealed through discussion of their experiences throughout the semester. The central focus of the story, of course, was how their environmental identity was affected by the activities experienced in the classroom. In Chapters 3 and 4, we saw how various activities either affirmed students' environmental identity or disconfirmed their consumer-materialist identity, a term suggested by the work of Dittmar et al. (2007). Activities such as the ecological footprint, the list of everything they own, and the India status of women and PETA videos had the effect of disconfirming students' consumer-materialist identity. Through these activities, students' values related to our materialistic culture were brought into question. The findings revealed examples of the students responding with the defense mechanisms McCall and Simmon's (1978) call "short term credit," "selective interpretation," "scapegoating the audience," and occasionally making changes in their identity structure. Alternatively, activities such as taking students outdoors, the town meeting, the videos on
poaching, and the school recycling program affirmed students’ environmental identity, as their environmental values were strengthened or new values were appropriated. As a result of different combinations of these affirming and disconfirming activities, we saw a change in the environmental identity of a few students, such as C.P., Kat, and Greg, as they moved from the salience stage of environmental identity development to one of personal empowerment (Greg) or more deeply into the empowerment stage (C.P. and Kat). We saw a similar change in Payton in Chapter 4 (moving from the salience to the empowerment stage) as she responded to the disconfirmation of her materialistic values by making a conscious change in her consumer behavior.

The experiences of these students demonstrate that while activities that disconfirm aspects of students’ identity can be very powerful, unless they are coupled with activities that provide positive ways that the student can become involved in helping the environment, then students may feel disempowered and helpless in the face of overwhelming environmental problems. We saw this in the initial responses of C.P. and Kat to the ecological footprint, as well as from Barrett, the most cynical of the interviewees, throughout the semester. The first two gained a sense of empowerment, and began to take further steps in their own lives that they felt were making a difference. Barrett, on the other hand, continued to use the argument that there are too many other people in the world acting irresponsibly for him to make a difference. Addressing this argument may be an especially important role for the Environmental Science course, as this is a common argument made amongst people in the general population. These findings suggest that if we want students to leave an Environmental Science class feeling empowered, rather than overwhelmed, then it is crucial that we include positive ways that
students can take action (both individually and as a group), rather than only raising their awareness of distressing environmental problems.

We now turn to Rick, who provided us with an example of a student whose negative experiences in a school setting affected his willingness to consider many of the discussions that took place in the classroom, despite his own love of nature. Therefore, the class had little impact upon his environmental or consumer-materialist identity. Rick represents a clear example of how a student’s openness and willingness to critically reflect upon his own beliefs and behaviors can play a role in how a student’s identity and behaviors are affected (or not) by an Environmental Science course. We saw in Rick’s case that he was neither open nor willing to critically reflect on the new information provided in the class as his relationship with the teacher deteriorated. Rick’s example demonstrates the importance of the alignment of a student’s expectations of the “teacher role” and the teacher’s actual practice, as Rick’s view of the appropriate role for an Environmental Science course did not include hearing the teacher’s advice and opinion on the issues being presented. This conflict represents a level of cultural tension between student and teacher that is further discussed in “The Role of Cultural Tension” section below.

Other students, such as Greg, who were more open to the new information, still had a very difficult time critically reflecting on this information to the point where they were considering any significant changes in their own lifestyle. In contrast, C.P., Kat, and Payton were able to engage in at least some level of critical reflection, which ultimately led to a shift in thinking regarding certain behaviors. While this study begins to show that there is some relation between the factors of identity affirmation/disconfirmation,
openness, and critical reflection, as diagrammed in Figure 2 in Chapter 3, the nature of this relation needs to be further explored in future studies.

In summary, the study findings demonstrated that the salience of the student interviewees’ environmental identity was augmented as their overall awareness of environmental issues increased, with the exception of Rick. Although he was exposed to new environmental issues, he was so closed off to the class that it is doubtful how much information was appropriated. We saw examples with Greg, C.P., Kat, Payton, Simon, and Allen of students taking action during the semester on a number of different levels ranging from a more significant commitment to recycling to giving up meat-eating. These actions supplied this group of students with a sense of agency and empowered them to feel they could make some sort of a difference through their own actions. This seems to be evidence that the students are now within the empowerment stage of environmental identity formation, as described by Kempton and Holland (2003). The students Rick and Barrett did not develop into this stage, however, for different reasons. For Rick, because of his lack of openness to the experiences in class (due to both his negative prior experiences in school and the misalignment of his expectations of the “teacher role” and her teaching strategies), and for Barrett, because he continued to doubt whether his personal behavior could have any influence on the larger system, which limited the amount of action he was willing to take. From this assessment, it did not seem that any of the students entered into the activist phase of environmentalism, as none had substantially reached out beyond the class and their personal behaviors to become part of the broader environmental community. However, it is possible that a few students, such as C.P., Kat,
and Simon (as noted in their own comments during their final interview), may take this step in the future.

**The Role of Emotion**

Smith (2005) suggests that “the process of ethical becoming requires an emotional openness to circumstance that enables the previously determined boundaries of our being to be re-constituted and re-interpreted” (p. 220-221). Additionally, the study by Horwitz (1996) highlights the importance of emotions such as passion, love, and outrage for the environmental activists who wrote of their life experiences which gave rise to their environmental beliefs, while the investigation by Kals et al. (1999) demonstrates the positive effect of “emotional affinity towards nature” on participants’ nature-protective behavior. The current study expands on these findings regarding the role of emotion for the adolescent students in this Environmental Science course as they experienced various activities that affirmed or disconfirmed aspects of their identity. In this investigation, emotion was explored in a more immediate manner by documenting students’ reactions to activities, rather than focusing on overall emotional attachment to nature.

Throughout the interview data presented in the results chapters, we see students using words like “angry,” “frustrated,” “disturbing,” “fun,” indicating that experiences in the course were affecting them on an emotional level. We also saw in Mrs. P’s goals reported in the results section of Chapter 5 that she sees a major role for emotion in influencing students to become more environmentally conscious. As she states in her first interview (2/4/09):

*The trick is this—I want them to be emotional about this stuff. I think that the culture here does not encourage a lot of emotionality, if that’s a word, and I try to encourage them to feel safe enough in the room that they can feel emotional about something and that that’s often times a good response to certain*
situations... Sometimes when people begin to critically think, the emotion, the emotional aspect of it gets depressed a little bit, and they get a lot in their head and the compassion part of this, that I think is so important, that compels people to want to change their behavior or compels people to want to talk to other friends about the importance of being a certain way, you know, that’s driven I think by something, as [a professor] always used to tell me, “It’s the fire in the belly” kind of thing, and that’s an emotionally driven thing.

In order to evoke this emotion in students, Mrs. P incorporates movies such as the India status of women movie, the poaching documentary, and the PETA film. In reference to a video she shows about the Earth First! movement, she states, “When they learn about old growth forests they are going to see some things that will shock them, and some of them will get really angry about the way Earth First! operates out there and it will appeal to their emotions” (Interview 1, 2/4/09). Mrs. P sees evoking students’ emotions as one of the paths influencing them to take action, which can work in conjunction with or opposed to students’ reasoning through an argument. Mrs. P argues against a strictly factual, scientific approach to Environmental Science that does not impact students on an emotional level. This is in contrast to the recommendation of Edelson (2007) which states that the Environmental Science course at the high school level should focus only on the “science of the environment.” Recent criticisms of transformative learning theory are insightful here in gaining an understanding of why it may be important to incorporate both emotional and fact-based approaches to Environmental Science. Taylor (2001) from a neurobiological perspective explains how “contemporary research is revealing a more integrated relationship between the physiological process of cognition and emotion” (p. 222). It is now evident that decision-making is often directly guided by emotions, often on a non-conscious level. According to Taylor, emotions establish the agenda for desires and beliefs, and they help us decide what to consider cognitively and how to respond.
Therefore, he suggests that transformational learning is often guided by or interconnected with emotions and feelings, and that critical reflection and emotions are interdependent processes (Taylor, 2001). Additionally, the work of Kovan and Dirkx (2003) with environmental activists reveals that the process of transformative learning that has resulted in their commitment to environmentalism is largely spiritual, involving elements in the non-rational realm, with activists working through stages of hope and despair, while maintaining their passion for the cause. They conclude that the inner self is very involved in working through these stages (utilizing both rational and non-rational elements), and suggest that transformative learning is a long, sustained process occurring over a considerable period of time (Kovan & Dirkx, 2003). While the time span of this Environmental Science course was likely too short to see change that might be labeled as "transformative," the study did document students struggling on both cognitive and emotional levels with the information presented in the course. In Chapters 4 and 5, several examples were presented of students responding emotionally to events (activities or films) in the class, which either coincided with or led to varying levels of critical reflection. It is important for teachers to be aware of students, such as Mariah and Kat, experiencing strong emotional reactions to activities, and help direct their emotions towards positive action. Taken together with the critiques of transformative learning theory, this indicates that by paying attention to the effects of experiences in the Environmental Science course on an emotional, as well as a cognitive level, teachers may better anticipate the responses of students and therefore more effectively achieve their goals for the class.
As noted in the above section on environmental identity, Stryker's identity theory of emotion helps us to understand why students respond emotionally to activities in class when their environmental identity is affirmed (This activity is “fun.”) or their consumer-materialist identity is disconfirmed (That activity was “disturbing.”). Additionally, Heise’s affect control theory proved useful in interpreting the students’ emotional reactions to classroom structures that did or did not meet their expectations. This theory states that the level of emotional response to a situation is determined by the correspondence of what Heise calls *fundamental sentiments*, or culturally established expectations about identity roles and behavior, and *transient impressions*, or feelings about how individuals acting within a specific situation or event are meeting expectations (Turner & Stets, 2005). The clearest example from the study was students’ comments when they felt that the teacher was being too one-sided in her presentation of the issues, which is discussed further in “The Role of a Presenting a Balanced Approach” section below. This did not meet with the *fundamental sentiments* of how students viewed the “teacher role” at their school. Although this study provides us with some indication that emotion plays an important role in students’ reactions to classroom activities and structures, more work needs to be done to determine more specifically *how* emotion interacts with identity and critical reflection in the Environmental Science classroom.

One aspect of emotion that was not studied in depth in this study was students’ emotional attachment to place. Orr (1992) says that to know a *place*, one must understand that

A place has a human history and a geologic past: it is a part of an ecosystem with a variety of microsystems, it is a landscape with a particular flora and fauna. Its inhabitants are part of a social, economic, and political order: they import or
export energy materials, water, and wastes, they are linked by innumerable bonds to other places...It can be understood only on its terms as a complex mosaic of phenomena and problems. (p. 129)

This knowledge of place, at least in the sense described here, was overshadowed by the teacher’s goals of awareness (environmental issues and impacts of personal behavior) and empowerment in this Environmental Science course. It was therefore difficult to assess the impact that spending time outdoors has on a student’s environmental identity and pro-environmental behaviors. A future study in an Environmental Science course that is spending more time doing field work outdoors would be useful in investigating how this interaction with the local environment affects students emotionally and in turn, their environmental identity. By developing students’ “emotional affinity for nature,” the construct developed by Kals et al. (1999), it would be hypothesized that positive outdoor experiences involving field research would affirm or strengthen students’ environmental identity. However, until more research is done it remains unclear what effect, if any, this type of interaction with nature would have on students’ environmentally-related behaviors.

**The Role of Empowerment**

In the teacher’s interviews, she emphasizes that while one of her main goals is to raise the awareness of students in terms of both environmental issues, as well as awareness of the impacts of their own environmentally-related behaviors, she feels that the class should go beyond raising awareness into the realm of empowerment. She felt this was especially important given the socioeconomic and situational challenges these students face in their home lives. This goal is outside of the traditional objectives of environmental literacy which include environmental knowledge, skills, attitudes and
behaviors. However, empowerment is directly related to the concept of self-efficacy, which is defined by Bandura (1986) as “the confidence that individuals have in their ability to plan and execute a course of action and to accomplish a task or solve a problem” (cited in Meinhold & Malkus, 2005, p. 512). The findings of Meinhold and Malkus (2005) show a statistically significant correlation between self-efficacy and adolescents’ environmental behavior. In turn, self-efficacy is linked to locus of control because of parallels regarding one’s perceived abilities to change or control one’s life (Meinhold & Malkus, 2005). Locus of control is defined by Hwang, Kim & Jeng (2000) as “an individual’s belief in whether or not he or she has the ability to bring about change through his or her own behavior” (p. 20). Hwang et al. (2000) found that internal locus of control was the most significant factor affecting environmental attitude and intention to act, and suggest that environmental education programs should focus on establishing a strong internal locus of control in their participants by encouraging students to make their own decisions, evaluate solutions, and act upon these decisions. The findings presented in the results chapters of this dissertation explore in depth how issues of self-efficacy affected students’ emotional and behavioral responses to the activities in the Environmental Science classroom. For example, when we consider C.P.’s and Kat’s initial response to the ecological footprint activity, and Barrett’s throughout the course, it is evident that these students were struggling with issues of self-efficacy or internal locus of control (also discussed in “The Role of Environmental Identity” section above). C.P. and Kat felt that they lacked the power to change various aspects of their life, while Barrett maintained a feeling of being unable to individually make a difference in helping the environment. Their struggles raise the question as to whether it is effective to increase
students' awareness of how they themselves may be affecting the environment without coupling this information with knowledge of how students can take action to help the situation. Without an empowerment objective, students may be left feeling negative and helpless as a result of their increased awareness. As noted above, the development of environmental identity as described by Kempton and Holland includes three stages, only the first of which is raising environmental awareness, which leads to increased salience of one's environmental identity. The other two stages involve empowerment and taking action on a community level. It has been shown that active environmentalists have gone through all three of these stages of development, although not in a specific order (Kempton & Holland, 2003). We must consider, then, if we are satisfied with aiming the Environmental Science course towards only the first of these stages, if we want students to leave the class with a positive outlook on the role they can play in helping the environment. Additionally, further discussed below in the section on “The Role of Cultural Tension” is the importance of considering the limitations on empowerment at the societal level, which Barrett indicated were preventing him from feeling as if he could make a difference.

Another related concept to that of self-efficacy and locus of control is that of agency, which has been defined as “the power to act and appropriate resources to meet one’s goals” (Lavan, 2004, p. 62). In the classroom environment, it could be hypothesized that if a person feels empowered during classroom activities (has a sense of agency), then this would lead to feelings of self-efficacy, whereas if she feels helpless, out of control, or taken advantage of (lacking agency), then this would lead to a lack of self-efficacy. The results from this study revealed that students may have gained a sense
of self-efficacy or agency from participation in activities like the town meeting, during which a student such as Simon felt that his voice was respected by his peers regarding this local environmental issue. Similarly, students, such as Greg and Allen, noted that participation in the school-wide recycling program helped them to realize the impact they can have through simple actions such as recycling. Here we see students developing a sense of empowerment as they partake in pro-environmental action.

Unfortunately, there were other situations where students did not feel comfortable sharing their opinions with the class. Mariah and Kat both expressed these feelings in relation to class discussion and the ANWR debate (see Chapter 4), presenting an example of how peer interactions can affect students’ comfort level in participating in a classroom activity. In an article by Bayne (2008), she discusses from a sociocultural perspective the importance of both individual agency and collective agency in creating a supportive classroom culture that moves towards meeting its goals. Here we see how power dynamics in the classroom can be directly related to student empowerment in collective learning situations, and directly affect the experience of students in the classroom environment. In the discussion of the findings in Chapter 4, it was recommended that students have an opportunity to practice their statement or argument before having to do it in front of the class, if this is possible, in order for students to gain more confidence in their own ability to make such a statement in front of their peers.

Another format which may work well for students with higher rates of low self-esteem is a non-debate, collaborative model of issue exploration in which the class works together to find a solution or compromise position together, which is referred to as a “collaborative controversy” type of activity (Bredehoft, 1991). This is an example of a
cooperative learning experience, which has a different focus from more traditional competitive learning experiences. Research has shown that this type of collaborative learning experience leads to higher levels of self-esteem, higher level critical thinking skills, in addition to increasing students’ motivation and positive attitude toward a given subject (Johnson et al., 1990). Therefore, this may be an effective teaching and learning strategy to employ with lower level students in an Environmental Science course where issue exploration is a focus of the curriculum. This method may lead to greater feelings of both individual and collective agency, which in turn is likely to affect how students feel about their ability to “make a difference.”

**The Role of Presenting a Balanced Approach**

The North American Association for Environmental Education’s *Excellence in Environmental Education: Guidelines for Learning (Pre-K-12)* (revised 2004) contain very specific suggestions for what should be taught at the 9-12th grade level, divided into the categories of Strand 1: Questioning, Analysis, and Interpretation Skills, Strand 2: Knowledge of Environmental Processes and Systems, Strand 3: Skills for Understanding and Addressing Environmental Issues, and Strand 4: Personal and Civic Responsibility (http://www.naaee.org/npeee/learner_guidelines.php). In these Guidelines only Strand 2 includes the “science of environmental systems,” while the other strands involve developing both analysis and action skills, in addition to a sense of responsibility for helping the environmental on both personal and community levels. While we have already discussed the importance of developing students’ sense of empowerment with regards to taking pro-environmental action, we have yet to discuss how Strand 3’s
"Understanding and Addressing Environmental Issues" fits into the Environmental Science course.

In the Environmental Science class which was the setting for this research project, rather than focusing the class only on the "science" as is recommended by Edelson (2007), Mrs. P based the curriculum around environmental issues, which she presented in an interdisciplinary manner. Therefore, in addition to teaching scientific aspects of the issue, she also emphasized economic and social implications of the issues as well. For example, in the unit about old growth forests, she not only taught students about the characteristics of an old growth forest, but also discussed the debate in the Pacific Northwest between the logging industry and environmentalists. Topics during discussion ranged from Earth First!, a moral debate about tree spiking, jobs of the loggers, the Northern spotted owl, to possible solutions. One of the issues that emerged in the study findings in utilizing this type of approach to environmental topics is that of whether the teacher’s presentation of the issue is perceived as being one-sided (i.e., biased) or balanced by presenting multiple perspectives on the issue. The following vignette demonstrates Allan’s perception of the teacher’s balanced presentation of the issue of logging:

I actually think she presents it both ways because when we were talking about the logging, she doesn’t like the fact that the logging is going down [as in “happening”], but she’s not so far on that side to not understand that people’s jobs are going to be lost if we just stop logging altogether, so she presented the fact that we’re losing all these resources, but we need that resource too, to build houses, to build other things that we need. (Interview 2, 4/15/09)

Overall, students felt that Mrs. P did a better job presenting a balanced approach during the units at the beginning and end of the semester than the unit on the agricultural
industry in the middle of the semester. In the following vignette, C.P. realizes that there are other sides to the issue of using DDT as a pesticide that Mrs. P is not presenting:

Yeah, and a lot of the stuff with the logging also made me think about how complicated the issue is, you know, not only is the environment at risk, but there’s also the livelihood of people, and the stuff about DDT, um, yeah, I mean it’s-, [sigh], I mean it kills birds and stuff, but I mean she didn’t bring up the fact that if you have a choice, if you lived in a third world country or a developing country, whatever they’re calling them these days-, if you lived in a country like that and your choice was either spray DDT and be able to grow crops and not have your family or yourself die of malaria or not spray DDT and, you know, have insects eat your crops and have you or your family die of malaria, I would spray DDT, and she just doesn’t address that, which kind of makes me angry...Like she doesn’t address the fact that a lot of times [sigh], yeah, a choice is environmentally poor, but to a lot of people it’s the lesser of two evils. (Interview 2, 4/7/09)

This selection is an example of a common theme expressed by students throughout the interviews, which is their desire for the teacher to present a balanced approach to the environmental issues. Here, C.P.’s perception that this issue was not presented in a balanced way actually evokes a negative emotional response from him, where he states that it “kind of makes me angry.” In Chapter 5, we saw that this type of emotional response can be caused by a discrepancy in students’ fundamental sentiments about how a teacher should be presenting these issues and their transient impressions of how the issue is actually presented (Turner & Stets, 2005). In this case, the students’ fundamental sentiments regarding the “teacher role” are that the issues should be presented in a balanced way, and if a student perceives that an issue is being presented in a one-sided manner, this discrepancy between his/her fundamental sentiments and transient impressions may lead to a negative emotional response, as we saw above with C.P., and from the other students whose comments are presented in Chapter 5.
Mrs. P is very cognizant that the perception of her students is often that she is a "passionate environmentalist." She realizes the importance of presenting a balanced approach if she is going to connect with her students and not be seen as presenting the issues in a biased manner. Mrs. P discusses her attempt to provide a balanced approach through showing films representing different viewpoints. In describing her curriculum for the course, she states:

Some of the case studies I have pretty cool videos that show...um, for example, when we are in our energy unit, I use the spill of the Exxon Valdez, and its impact on local fisheries, and I have two films, one that talks about the spill from Exxon's point of view and it's produced by Exxon, and the other one is a film produced by the people, the native Alaskans in Prince William Sound who were harmed, whose very livelihoods were taken from them as a result of the spill. (Interview 1, 2/4/09)

This example demonstrates the teacher's conscious attempt to present multiple sides of the environmental issues being discussed in class. At the end of the semester, during her third interview, Mrs. P adds that

showing two dramatically different sides to an issue, I think always works with them... One of the important things for me in teaching the course was in getting them to understand that there's always two sides to every one of those issues, and that even though I tell them what my bias is, all I want to do is show me that they can make a good argument, whatever side they take, just make a good argument. (Interview 3, Part 1, 6/25/09)

Despite her attempts to present multiple sides of the various issues, Mrs. P is unaware of her students' perception mid-semester that she was one-sided and not willing to listen to their varying opinions, which created a negative reaction amongst many students in the course. This example of how sociocultural interactions can affect learning in the classroom is further highlighted in "The Role of Cultural Tension" section below.

During the third interview, in response to the above comment and interviews with the students, where they stated after the ANWR debate that they did not know which side
they were on, Mrs. P was asked if she perceives that this is at all confusing for students who may not know which side is “correct.” She replies, as follows:

Yes, of course it does [confuse them]. On the one hand they want to be told what to think cause it’s easier, and because most of those kids are really lazy. They would rather just be, “Just tell me what you want me to think here,” but of course I don’t want to do that, and the same thing happened at [the university]. Kids got really angry with me because I wouldn’t tell them what to think, and then by the end of the course they understood that it was better to actually think through how you think. So, I’m okay with them being confused. I think that with this material almost more than any other material that they take throughout their whole high school career, I think that the weight of it, the importance of it is manifest down the road. They have to go out and live a little bit and see how this material fits into what their experience of life is, and I think that critical thinking skills take a really long time to develop, and I know that they’re not going to become critical thinkers at the age of 16 or 17, but I feel like I ought to-, I have a responsibility to try to push them that way, even though they might be confused by it. (Interview 3, Part 1, 6/25/09)

In this comment, we begin to see the connection between presenting a balanced perspective and relying on students’ critical thinking skills to sort through the different sides of the issues. As noted by Mrs. P many of these students have not yet developed their critical thinking skills, and are therefore left unsure of where they stand at the end of an activity or unit. While Mrs. P says that she’s “okay with them being confused” we must consider how this fits in with our overall educational system norms. Given the current emphasis on standardized assessments where there is always a “correct” answer, students may not be used to a class where the “correct” answer is not presented to them.

In this way, the Environmental Science course presents a rare opportunity to encourage critical thinking in our students as they study often complex environmental issues that do not come with a right or wrong solution. However, given that students may have had limited prior experience with assessing different sides of issues from a critical standpoint, this should be taken as an indication to teachers that it is crucial to provide scaffolding for
students in the development of their critical thinking skills. It may be necessary, therefore, to take a step-by-step approach to assessing the legitimacy of an argument by discussing concepts such as relevance and validity of premises with students, and then giving students the opportunity to practice these skills by conducting their own formal assessments of arguments presented on different sides of an environmental issue. This recommendation is a step beyond a discussion of the source of information and whether it is trustworthy or not, which is a conversation many teachers have with their students regarding utilizing sources from the internet. Rather, teachers need to go beyond a conversation about the source of the content and into discussion and practice assessing the validity of the actual arguments within the content.

**The Role of Behavior Change**

Results of the behavior survey given to students at the beginning and end of the semester showed that the average behavior score on the ecological footprint decreased from 17.29 on the pre-survey to 15.76 on the post-survey, indicating a decrease of 1.53 points on average per student over the semester. This decrease in their “ecological footprint” indicates that of the 15 items on the behavior survey, students on average changed 1 to 2 of these behaviors in a pro-environmental direction during the semester. We saw in Chapter 3 that the types of behavior changes varied by student. C.P. was an example of a student who changed a more culturally-embedded behavior, which was eating less meat in this case. Kat changed other less deeply-embedded habits such as turning the tap water off while brushing her teeth, taking fewer showers, and using scrap paper. During the semester, Greg became more committed to recycling and not littering, and because of his role as a leader in the class that students looked up to, became a role
model for other students in promoting recycling. In Chapter 4, we saw Payton changing her decision-making regarding buying material items that she decided she did not "need." Therefore, we saw students changing their behavior in multiple ways during the semester, as each of them was affected by various activities and interactions in the course.

It was also evident that students often had a limit on what they were willing to consider changing. For several students (Kat, Greg, Rick, etc), eating meat was a behavior that they were not willing to consider changing, even after multiple activities which presented the negative aspects of eating meat. The important role of family and societal norms in influencing this limitation is discussed further in the next section (The Role of Cultural Tension) below. Another example was Greg, who was not willing to give up his recreational sports hobbies, despite his knowledge that they are not "eco-friendly." There is an important implication here for educators attempting to get students to critically reflect upon their own behaviors, which is that when a student is committed to a behavior on an emotional or non-rational level, the student is not likely to be rationally convinced that changing this behavior is necessary. We saw multiple examples in the class of students using the various defense mechanisms described by McCall and Simmons (1978) to avoid significantly changing their behavior. Therefore, it is important for teachers to assess the commitments of students to various behaviors as they determine upon which issues they want to focus their curriculum.

Despite students’ unwillingness to change some of these behaviors, the student interviewees overall did not mind the teacher attempting to influence their attitudes and behavior towards the environment. When asked during her third interview about how she feels about a teacher trying to influence her in this manner, Kat replies:
K: I’m okay with it because I feel the same way. If I didn’t feel the same way, I would be probably totally against it.
E: Hm, okay, because you feel like you pretty much agreed with most of what Mrs. P was saying anyway.
K: Yeah...For me, if a teacher is passionate about what they’re teaching, I tend to learn more, so it works better for me.
E: Yeah, [so] for this class you were okay with it.
K: Yeah. (Interview 3, 6/8/09)

Another student, Simon, states the following reason for his belief that this type of class has an important role within the school:

S: It’s essentially our job as students to learn and be influenced, and that’s what it does...If you have a teacher that’s really enthusiastic about the material matter and they want to teach and they want people to learn, then they’re going to influence some people, and that’s, I think that’s ultimately what they hope for.
E: Right, yeah, and you’re okay with that as a student? With a teacher trying to influence you?
S: Well, yeah, I like learning. I think everybody does, it’s just some people don’t like school. (Interview 3, 6/12/09)

Here we see Simon equating being influenced with learning. He later states that he realizes that he has the ability to evaluate the opinion of the teacher and make his own decisions, which is why he feels the influential nature of the class is appropriate.

In contrast to the views of Kat and Simon, one student expressed wariness of the role of the Environmental Science course at influencing students’ attitudes and behaviors.

This student, Rick, states:

R: Well, I don’t think they should try to persuade people. I think they should just teach people like the benefits and then the consequences and stuff, like they shouldn’t try to persuade people.
E: So do it much more from like a factual, scientific approach?
R: Yeah, just let people think what they want, do what they want, but let them know what’s going to happen if they do it and what won’t happen if they do it, stuff like that. (Interview 3, 6/8/09)

From this statement, it seems that Rick would be in favor of a more content-driven approach to the class, rather than one emphasizing action. This view differs from that of
the students quoted above, who seemed to appreciate being taught strategies for changing their behavior, rather than simply being taught of the negative consequences. The difference in student reaction here indicates the need for the Environmental Science teacher to carefully assess and continually monitor how the students are reacting to presentation of different strategies for environmental action, and to adjust their teaching style accordingly.

One of the interview questions for the teacher during her second interview was aimed at trying to discover how implicit or explicit the teacher felt she could be in trying to influence students’ behavior. Mrs. P responded, as follows:

P: I know that I am purposefully not out there trying to work on their behavior because that is the sure-fire way to get them to do exactly the opposite, so I guess I’m implicit.
E: Right, okay, so you’re consciously not telling them like “Do this, do that.”
P: Right, I’ve done that before and it’s been a disaster.
E: Yeah, okay, and so, what did you find were the students’ reactions?
P: “Don’t tell me what to do.” I mean, right in my face...Not that I did tell them what to do. I was only hinting strongly that maybe acting differently would make for a better world. Well, you know, I was told in no uncertain terms by them, and in one case by the kid’s father, that there was no way, so I don’t do that anymore.
(Interview 2, Part 1, 4/29/09)

Despite Mrs. P’s insistence here that she does not explicitly try to influence students’ behavior, activities during class such as the ecological footprint, having students make a list of everything they own, taking part in the school recycling program, and class discussions related to meat-eating practices, clearly have the intention of awakening students to the impacts of their behavior and presenting alternatives. As noted above, however, students generally seem to accept being taught about alternatives to their consumer lifestyle as part of an Environmental Science course. Interestingly, many teachers perceive that they cannot explicitly inform students of alternative behaviors
without getting a response as Mrs. P describes above; however, in this study that extreme response did not seem to occur amongst the majority of student interviewees. More research is therefore needed to determine what factors contribute to making explicit teaching about alternative pro-environmental behaviors acceptable to students.

In determining the goals for the Environmental Science course, and whether behavior change should be among those goals, Mrs. P’s comments regarding this subject are informative. When asked whether it is a goal of hers to see behavior change in her students, Mrs. P replies in the following vignette that she does not expect to see immediate changes in student behavior that go beyond the classroom. One reason is because she has no way of knowing what their behaviors are outside of class, but also because

people are very reluctant to change just because they’ve heard the truth, because they’re reluctant to realize, or admit to, having heard the truth, and so it takes I think years for people to mull this stuff over and to test the ideas out in the world, and so it’s not surprising to me ever that at the end of a course people say that they are not willing to change because my experience has told me that years after they have had the course they have a realization, they see something that resonates with them. I don’t think that they forget this stuff very easily. They are going to forget a lot of the details, but the gist of it they are going to hold with them. (Interview 1, 2/4/09)

Mrs. P therefore chooses to focus the goals of the course upon awareness (both of environmental issues, as well as how individual behaviors are impacting the environment) and empowerment. Her hope, however, is that in the long-term students will use what they have learned in class to reconsider some of their behaviors in the future.

It is noteworthy from the participants’ perspectives on behavior change that these students are generally not opposed to learning about the negative impacts of their
behavior, and at least a few of the students prefer to be presented with alternative actions of how they can help the environment. Since teachers like Mrs. P feel that they must be careful not to be too explicit in presenting students with ways to change their behavior, more work needs to be done to discover how to create an acceptable balance in presenting students with alternative actions without causing them to feel they are being told what to do. Mrs. P seemed to achieve this delicate balance as few students expressed negative feelings about the influential nature of the course.

**The Role of Cultural Tension**

Throughout the dissertation data, there is an underlying current of cultural tension between various classroom participants on multiple levels—classroom culture, school culture, and the broader culture of society—which is the focus of this section. *Culture* is defined in the field of cultural sociology (Sewell, 1999) as “as a weakly bound system of schema and practices that interact in a dialectical relation with each other, material resources, and agency (the power to act and appropriate resources to meet one’s goals)” (LaVan, 2004, p. 62). The first of these, classroom culture, relates to how the teacher presents the course through a knowledge-based lens which exists in tension with the hands-on, artistic, or more emotionally-driven students in the classroom. The second level of tension operates at a level above the classroom, focusing on the role of school as an institution which places teachers (whose goals may be at odds with the desires/expectations of the students) in an authority role. The third level of cultural tension is operating at a societal level beyond the scope of the classroom, where students’ experiences outside of school influence them in such a way that the assumptions underlying their worldview may be in conflict with those assumed by the teacher.
Examples of each of the above levels of cultural tension are explored below, accompanied by a discussion of the conceptual theories that provide a framework for understanding this tension.

The sociocultural perspective utilized in this study brings to the fore issues related to the cultural background of the classroom participants as they interact with each other, the classroom structures, and the course material. This focus highlights ways in which the teacher’s cultural background may be in tension with the values of the students in the classroom. The student participant named Mariah in the current study represents an example of the importance of how information is presented to students who may not value scientific knowledge in the same manner as the teacher does. For example, the teacher’s strong educational background in pursuit of a doctoral degree in the ecological sciences places a high value upon knowledge esteemed by the scientific community, as Mrs. P on several occasions refers to the quote she has posted on the classroom wall stating, “Knowledge is power.” During class, while Mrs. P is sharing this knowledge with her students during classroom dialogue, Mariah is continuously drawing sketches (unrelated to the course content) in her notebook, which she stated helps her to pay attention. When asked specifically whether the Socratic dialogue style helps her to learn the information, Mariah states during her first interview (2/18/09):

M: I learn better with imaging stuff than hearing.
E: Mm, okay, what do you feel like you get out of the discussions?
M: Um, I get bits and pieces because I have ADHD and my mind kind of goes in and out even though I’m on my meds, so it’s a little bit confusing, but I string pieces together.
E: Yeah, so every once in a while things seem to stick.
M: Yeah, sometimes it gets caught in there.
Mariah states here that visual images help her to learn, which is evidenced by the strong emotional impact that the video documentaries shown during class have upon her. While Mrs. P states that she is attempting to influence students’ emotions, she does little to help them process their emotional reactions. Discussions following movies were more focused on a factual analysis of the issues discussed, which often included a discussion of the biases in the film, but rarely provided students like Mariah with an outlet for expressing her strong feelings (which are generally not encouraged in scientific fields). Therefore, we see a clear example of what Tobin (2007) refers to as cultural incongruence where “the social and cultural backgrounds of the majority of the teachers [are] so different from those of their students, they might not know how to connect their teaching to the cultural capital of the students” (p. 27). Many teachers tend to conceptualize the ideal learning environment based on their own cultural backgrounds and educational experiences, which may be divergent from their students and thus deleterious to students’ learning. According to LaVan (2004), these teachers often use instruction styles that are at odds with the culture of the students, thereby promoting unfavorable interactions.

Additionally, four of the male student participants, who were enrolled in the vocational (building trades and machine shop) program at the school, discuss their preference during both interviews and cogenerative dialogues for more hands-on type learning activities, as they had difficulty transferring the “knowledge” they were hearing during class dialogues into a meaningful context. While some of the tension discussed in these examples could be due to differences in learning style, the source of this tension may go beyond this to the deeper question of how we present the environmental course to students. At its core is a focus on “science,” as in the name of the course “Environmental
Science,” which places the course within the scientific realm inclusive of the assumptions, ways of knowing, and ways of teaching that are commonly associated with the Sciences. For example, Snively and Corsiglia (2001) have described “Western modern science” as being based on logical empiricism (positivism), universal principles regardless of context, an emphasis on control and manipulation of nature, and reliance on observation and experimentation over a limited period of time. Several studies have revealed that these assumptions help students who see themselves as “potential scientists” to excel, while alienating students who do not aspire to become scientists (Aikenhead, 1997; Brickhouse, 2001). Buxton (2005) has also found that the misalignment of students’ own worldview with that presented in the science classroom can have a significant impact on students’ identity. An important implication of this is that when a course is taught from a scientific perspective, it may cause more than an unfavorable experience or poor grades for a student like Mariah; rather, it could have a deeper impact on her identity, as it presents a message defining who she can and cannot be in the science-based community.

There are alternative ways of presenting the environmental course that encompass other ways of knowing about the world. For example, the course could be presented from a perspective of caring (Noddings, 1992, 1995, 2002; Martin, 2007), art, literature, journaling, nature exploration, or indigenous ways of knowing (Cobern, 1996; Snively & Corsiglia, 2001). Each of these approaches deserves an entire essay of its own, beyond the scope of this dissertation. However, a consideration of these alternatives leads to the following broader questions: How do these approaches interact with “science”? How do we appeal to students for whom the scientific, knowledge-based approach is not
effective? How would course goals change if the course were placed in a humanities
department? Rather than attempt to provide answers to these questions, they are meant to
evoke further thought and discussion within the education community as our methods of
teaching students about the environment are further developed.

A second type of cultural tension that existed within the classroom was a clash
between students' expectations of the role of the teacher in the greater context of the role
of schooling, and their perceptions/experiences during this Environmental Science
course. During the results chapters of this dissertation, Heise's affect control theory was
useful in understanding why students experienced negative feelings when their ideas
regarding schooling and the "proper" role of the teacher were challenged during this
course. The student who exemplified the most extreme negative response to this
misalignment was Rick, who entered the class with negative feelings towards school-
based authority as a result of previous experiences in the school environment.

Interestingly, when the class began, the Socratic dialogue technique used by this teacher
appealed to Rick as it gave the students a voice and the agency associated with sharing
their ideas on the issues being discussed in the course. However, as Mrs. P became more
opinionated in her presentation of the issues during the middle portion of the semester,
this caused an extreme negative reaction from Rick who stated that he did not feel that a
teacher should be attempting to persuade her students (Interview 3, 6/8/09). For other
students, although their reaction was less severe, they also negatively responded when
they felt Mrs. P was presenting only one side of the issues and not listening openly to
student opinions. The misalignment here is between student expectations of a balanced
presentation of the issues, as discussed in "The Role of a Balanced Perspective" section
above, and student perceptions of a one-sided presentation in the classroom. Rick is the only student, however, who discusses feeling uncomfortable with the influential nature of the course as well. For Rick, this clash was enhanced by previous negative clashes with authority figures in the school environment, and he began to see Mrs. P as just another power figure within the institution of schooling, thereby diminishing any feelings of agency he had experienced earlier in the class. This finding is in line with the findings of Loman (2005) who, in describing the importance of agency, states that “the dispositions to act, as a result of a person’s habitus depend on the capital the individual holds in the field of the classroom” (p. 174). The idea of agency is therefore closely associated with the power dynamics of the classroom, and can lead to struggles between classroom stakeholders. Unfortunately, conflict between Rick and Mrs. P results when Rick feels his individual agency is being compromised rather than supported.

The type of cultural tension discussed here indicates that students’ prior experiences and their own ideas regarding schooling are important factors affecting students’ experiences in the classroom. Although the teacher may have little control over these ideas that students are bringing with them to the classroom, by paying attention to students’ expectations as well as student feedback regarding their feelings of agency within the classroom, the teacher may be able to gain a better understanding and find resolution to conflicts as they arise within the field of the classroom. For example, if a teacher discovers as a result of student feedback that students are not feeling that their ideas are being respected (either by the teacher or by fellow students), then the teacher can take steps—through changes in her own behavior or approach and through class discussion—to shift the classroom culture to one that is more open and respectful.
Alternatively, if a teacher perceives that students are having difficulty with the “influential” nature of the course, then the teacher may need to restructure her approach so that alternative actions are generated by the students rather than the teacher. This change should also have a positive impact upon the feelings of agency of the students in the classroom environment.

The third area of cultural tension highlighted in the results relates to differences between the teachers’ experiences with societal culture and the students’ experiences. There are two examples presented here which are operating at this level, the first focusing upon students’ sense of empowerment within their world outside the school environment and the second focusing upon the influence of societal/family norms with which the environmental course at times seems to be competing. The first of these is exemplified by the student participant named Barrett, whose lack of self-efficacy regarding his ability to “make a difference” through environmental action, is discussed extensively in the results. It is important to note here, additionally, that a clash exists between the teacher’s goal of empowering the students to feel they can make a difference (which is based on the underlying assumption that they actually can), and this student’s feelings that his individual behavior cannot make a difference. Therefore, even though the teacher can help enhance students’ sense of agency within the classroom, their sense of agency or self-efficacy in the world may be lacking as a result of their life experiences, making it very difficult for a teacher to affect the students’ behavior outside of the classroom.

The second example of cultural tension at the societal level is the conflict the class presents for students when the environmental ideas presented clash with their family culture, which is often reflective of societal norms. The clearest example in the results
chapters is that of the discussions around the topic of the agricultural industry and meat-eating, which in much of our society is an accepted norm. By asking students to consider reducing their meat-eating (in addition to changing other culturally-embedded behaviors), the teacher is asking the students to consider much more than an individual behavior, but rather whether their family and culture has presented them with the "correct" way of living. This type of promotion of students' critical reflection upon their values (and therefore the source of those values) moves the Environmental Science course into territory which requires the teacher to walk a fine line between what students could interpret as "subtle influencing" versus "inappropriate judging." The Environmental Science teacher, then, must consider very carefully how to approach issues that involve deeply embedded family and societal norms because her approach can determine whether a student effectively apprehends new information and critically reflects upon it or becomes turned off to the subject and its consideration entirely. This means that a teacher must evaluate which issues reflect deeply embedded values for her students, and if she decides to include these issues within the curriculum, then she must include multiple perspectives on the issue, give students the opportunity to openly share their views on the subject, and support them through the process of reflection (through writing, dialogue, etc.). This process of reflection would allow students to explore their own values without the feeling of being negatively judged by the teacher. As the current study has shown, if a teacher is perceived as only presenting her alternative views on this type of issue, then she risks alienating the very students she hopes to influence.

As the above examples demonstrate, at the core of this Environmental Science course are several issues of cultural tension which have a significant impact on students'
experiences during the course. The examples of Mariah, Barrett, and Rick demonstrate that there are students for which the Environmental Science course is not working effectively, and the reasons for this may go beyond easily changeable aspects of the teacher’s approach or the curriculum. For example, it may be beyond the teacher’s ability to change the students’ expected role of the teacher or societal norms; however, it is important for teachers to be aware of these existing layers of cultural tension because it is possible to change how they interact with their students when these issues come to the forefront.

**Conclusion**

The research questions for this study, centered upon exploring the process of change in students’ environmental identity and associated behaviors, led to the choice of ethnography as the methodology for this study. This methodology allowed for an inductive approach whereby events in the classroom and the participants’ responses to these events guided the direction of the research and findings that eventually emerged from the data. The sociocultural approach utilized in this study highlighted various aspects of the students’ experience in the Environmental Science course that ought to be considered in the creation and enactment of the goals and curriculum for the course, rather than focusing solely on the traditional objectives established by the Belgrade Charter (1976) of environmental knowledge, skills, attitudes, and behaviors.

The research approach utilized was helpful in establishing the important roles that identity, emotion, empowerment, a balanced perspective, behavior change, and cultural tension play in the Environmental Science classroom, but only begins to uncover the relationship between these factors. The symbolic interactionist identity theories of
emotion by Stryker (2004) and McCall and Simmons (1978) begin to illuminate the relation between identity and emotion as various aspects of one's identity are affirmed or disconfirmed in a given situation. The relation of these elements and those of self-efficacy, internal locus of control, and agency—all factors related to empowerment—remains unclear. However, the study results do reinforce the earlier findings by Meinhold and Malkus (2005) and Hwang et al. (2000) that these factors are important considerations in determining individuals' pro-environmental actions. Additionally, the idea of presenting a balanced perspective in the course emerged as being central to students' openness to the ideas being presented, and the effectiveness of this approach appears to be fundamentally connected with students' ability to critically think about multiple sides of an issue. Since few studies, if any, have considered how these factors are related within a formal educational setting focused solely on the teaching of Environmental Science (Zavestoski, 2003; Zelezny, 1999), further research regarding the relationships among these elements is needed in order to gain a deeper understanding of the roles of each in affecting students' environmental learning.

In interpreting the results of this study, it is also important to remember that the study was conducted in one Environmental Science class with one teacher and seventeen students. This was a lower level course that many students were taking because they wanted an "easy" alternative to chemistry, which several had previously failed. The seventeen students were all white, generally from working class families. The objective of the study was not to generalize the results to a larger population, but rather to discover what the experience was like for students and the teacher in this particular Environmental Science course. As noted throughout this dissertation, it will be important in future work
to determine how the experience may be similar or different for students in more culturally diverse settings and where the teacher is taking a different approach to the course than Mrs. P. For example, it may prove useful to investigate a classroom where the curriculum is focused more on the “science” rather than an interdisciplinary approach based around the issues; or studying a classroom where more time is spent doing fieldwork outdoors; or a classroom where the teacher is more consciously explicitly in trying to affect change in students’ behavior. Additionally, this research is focused on the semester long Environmental Science elective course, and therefore more research is needed to see how students’ experience in an Honors or Advanced Placement Environmental Science course, a freshman introductory course, or a full year Environmental Science course, may be different from the experience of these students.

It is also important to restate that the cogenerative dialogues were an invaluable source of data and relationship building between the researcher and the participants. In addition to the student interviews, this was another opportunity for the researcher and the students to get to know each other outside of the classroom setting. In addition to building social connections, the dialogues provided data on students’ feelings and reactions to events in the classroom in a more immediate manner than was possible with the interviews. Undoubtedly, the disruption of the cogenerative dialogue groups due to scheduling issues hampered the overall effectiveness of the cogenerative dialogues in reaching their potential for the development of student agency and improvement of the teaching and learning in the classroom. Additionally, the lack of continuity of the dialogues limited their impact on both development of peer-peer and student-teacher relationships. Therefore, in future studies in order for cogenerative dialogues to reach
their full potential, it is imperative to establish a regular meeting schedule with a consistent group of participants in order to allow for the level of comfort and openness amongst group members to improve over time.

Finally, as the Environmental Science course continues to gain in prominence in the twenty-first century, this study raises important questions about what the objectives should be for the Environmental Science course. The results indicate that if we want students to move beyond the first stage of development of their environmental identity, which is awareness or *salience*, into the stage of *empowerment*, then we must find an appropriate way to provide them with suggestions and opportunities for action. Otherwise, we will have informed students who may feel overwhelmed and helpless in the face of the massive environmental problems facing their generation. As teachers strive to create a course that is meaningful for their students, the findings from this study also indicate that it is important to choose issues that are relevant for the students in the class, and to present the issues in a balanced manner whenever possible, while encouraging the development of students' critical thinking skills to sort through the multiple sides of an issue. Additionally, we saw in this study the deliberate use of emotion in attempting to awaken students and stir their passions, and the results demonstrate the potentially critical role emotion can play in students' experiences in class. Therefore, how students are likely to react emotionally should be an important consideration in choosing the activities for the course. For example, one strategy, as we have seen in Mrs. P's class, would be to balance activities that will evoke students' negative emotions through identity disconfirmation with other activities that will evoke positive emotions by strengthening students' sense of empowerment and their
environmental identity. The study results therefore provide new guidance for Environmental Science teachers in designing a curriculum that will effectively promote students’ environmental learning.

Overall, the findings from this research would not have been possible without the cooperation of the teacher, Mrs. P, and the student participants in this study. It is their words that have been given a voice in revealing their experiences in this Environmental Science course. It is my sincere hope that their words will be informative to others in the field of science and environmental education that are working with students to help them define their relationship with the environment. Through student expressions of thought and emotion, this study has highlighted aspects of the Environmental Science course that are working and not working for them, providing insight for teachers in creating their Environmental Science curriculum. In addition, this chapter has described several areas where further research is needed to both confirm and expand upon the results of this study. We must continue to work as a research community to help inform educators about the best practices to augment the environmental learning of our students. This study marks another step along the path to accomplishing this worthy mission.


Tobin, K. *Twenty questions about cogenerative dialogues*. Unpublished manuscript.


APPENDICES
Appendix A: Pilot Study

Making a Difference: Are High School Environmental Science Courses Affecting Students’ Environmental Attitudes and Behaviors?

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384
Abstract

Despite the growing number of secondary schools offering an Environmental Science elective course (Edelson, 2007), few studies have been done evaluating these formal programs to determine what should be included to bring about the desired outcomes of improving students' environmental knowledge, attitude, and behavior. This study, conducted at 8 high schools in the Northeastern United States, utilizes an established survey for measuring environmental attitudes, the New Environmental Paradigm (NEP) scale (Dunlap, Van Liere, Mertig, & Jones, 2000) in order to measure students' attitudinal change over the course of semester long Environmental Science elective courses. Additional information is gained from a second survey, which is an “ecological footprint,” designed to provide information regarding the students’ change in environmental behavior. These surveys are given in a pre- and post-test format to students in an Environmental Science course \((n = 152)\) and their counterparts not enrolled in an Environmental Science course \((n = 105)\). Independent-t tests were conducted to determine in which classes a statistically significant change occurred in students' attitude and/or behavior scores on the survey compared with the control class at the same school. Additionally, a multiple regression analysis was completed to determine which student level variables could be used to predict the outcome of change in environmental attitudes or behaviors of the students. Results show variation in the effectiveness of the classes in improving students' environmental attitudes and behaviors, and may be used to inform curricular decisions in these courses.
Introduction

In the last decade, we have seen tremendous growth in the number of high schools offering an Environmental Science elective course, gradually gaining stature within the high school curriculum (Edelson, 2007). In fact, Edelson (2007) reports that teachers are finding that they are able to engage students in environmental science classes that have not been successful in other high school science courses. However, little research has been conducted to formally evaluate these courses’ effectiveness in educating students about the environment and empowering them to adopt pro-environmental behaviors (Zelezny, 1999).

Several researchers have developed various instruments to measure how environmental education programs are affecting environmental knowledge, attitudes, and behaviors of students (Bogner & Wiseman, 1999; Dunlap et al., 2000; Manoli & Johnson, 2007), and have tried to determine the relationship between these factors (Hwang, Kim, & Jeng, 2000; Kuhlemeier, Bergh, & Lagerweij, 1999). However, these studies have not focused on formal programs in American schools or attempted to determine what should be included in environmental education programs in our schools to bring about the desired outcomes. This study, therefore, focuses on Environmental Science elective courses in formal high school settings in order to determine how effectively these courses are teaching environmental attitudes and behaviors, so that we can begin to make informed curricular decisions in the development of these courses.
The aim of this study is to determine whether attitudinal and behavioral change is occurring for students at a variety of public high schools during an Environmental Science elective course compared with their peers who were not partaking in an Environmental Science course during the same time period. The constructs of “attitude” and “behavior” have been defined inconsistently in various studies; therefore, their significance in this study is discussed further below. The main research questions for this study can be summarized as follows:

1) Are students in high school Environmental Science elective courses improving their environmental attitudes and behaviors during the course significantly more than their counterparts in non-environmental science courses?

2) Can characteristics of a student’s background, engagement in class, and/or achievement level predict the student’s likelihood of being positively or negatively affected by taking an Environmental Science elective course?

3) Are there classroom level differences that are affecting the likelihood of students being positively or negatively affected by an Environmental Science elective course?

**Theoretical Framework**

**Background**

With few standards developed directly for Environmental Science classes, environmental educators often refer to the broad goal of widespread environmental literacy, which has been called for since the Belgrade Charter was established at the
International Workshop on Environmental Education in 1975 (UNESCO, 2007). Here the goal of environmental education was defined as follows:

"to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current environmental problems and the prevention of new ones." (The Belgrade Charter: A Global Framework for Environmental Education, 1975)

Since the establishment of this goal, a variety of programs in both the formal and non-formal educational sectors have been developed which have included various aspects of knowledge, skills, attitudes, and behaviors, but with little consistency in the concepts taught or teaching strategies used. Without any standard curriculum, the Environmental Science course at the high school level lacks this consistency as well.

Despite the variation in high school programs focused on environmental science, a few studies have investigated the relationship between environmental knowledge, attitudes, and behaviors among students at the high school level. Both Meinhold and Malkus (2005) and Kuhlemeier et al. (1999) conducted studies using a quantitative survey instrument to measure these constructs and assess their relationship. While their findings contradict each other regarding the relationship between knowledge and the other two variables, both find a strong relationship between environmental attitudes and behavior. Neither of these studies, however, considers how these variables may change for these students over time. Additionally, both of the studies target a large population
without a common exposure to an environmental course. Therefore, there is no attempt to
directly correlate study findings with any particular curriculum, coursework, or teaching
strategies, thereby limiting the usefulness for curriculum planning at the high school
level.

The following two studies did investigate change in environmental attitudes and
behaviors over time for a specific course. They both analyze a teaching approach called
the “Issue investigation-evaluation and action skills training model” (Culen & Volk,
2000; Hsu, 2004). Culen & Volk (2000) study how this program is implemented with 7th
and 8th graders, while Hsu (2004) evaluates this program as it is applied in a university
level Environmental Science course in Taiwan. Both studies used a quantitative survey
method giving pre- and post-tests to experimental and control groups of students.
Findings show increases in responsible environmental behavior, environmental attitudes,
and intention to act (Culen & Volk, 2000; Hsu, 2004) providing support for this teaching
approach within the given settings. However, the variance in the study outcomes is not
further analyzed, so it is unclear what other factors operating at the classroom or student
level may be affecting the change in environmental attitudes and behavior. Therefore, the
current study seeks to explore the factors at the classroom and student level that may be
contributing to positive changes in students’ environmental attitudes and behavior.

Measuring the Constructs of Environmental Attitudes and Behaviors

In keeping with the environmental literacy approach established by the Belgrade
Charter, researchers in the field of environmental education have focused their research
on assessing the effectiveness of programs at affecting environmental attitudes and
behaviors. These constructs have been measured primarily through the development of survey instruments. However, the construct validity of these surveys is often uncertain as researchers, attempting to define terms like “environmental attitudes,” will use equally vague concepts such as worldview, beliefs, perception, and values (Bogner & Wiseman, 1999; Dunlap et al., 2000). The construct of environmental behavior has been defined even less consistently, with researchers creating their own behavior surveys appropriate to the given setting (Culen & Volk, 2000; Hsu, 2004; Hwang et al., 2000; Kuhlemeier et al., 1999; Manoli & Johnson, 2007; Meinhold & Malkus, 2005).

One of the most widely-used scales in the field of EE research for measuring environmental attitudes is the New Ecological Paradigm (NEP) scale established by Dunlap, et al. (2000), which has been chosen for this study. Dozens of studies in several countries have been conducted with the NEP scale, mostly in general population studies, but also with specific groups of students and ethnic minorities (Dunlap et al., 2000). This scale is a 15 statement Likert scale survey with alternating statements in the “pro-environmental/pro-anthropocentric” direction regarding balance of nature, limits to growth, human domination of nature, and ecological catastrophes. Examples of survey statements include “Humans have the right to modify the natural environmental to suit their needs” (human domination) or “Plants and animals have as much right to exist as humans” (balance of nature) (Dunlap et al., 2000).

In the study reporting the validity and reliability of the NEP scale, the authors suggest that the NEP scale can be used as “a measure of endorsement of a fundamental paradigm or worldview, as well as of environmental attitudes, beliefs and even values”
Appendix A (continued)

(Dunlap et al., 2000, p. 427). They state that a set of beliefs or attitudes about the environment constitutes a “paradigm or worldview,” and that a high score on the NEP scale reflects a “proenvironmental orientation” or “ecological worldview” (Dunlap et al., 2000). The advantages of this scale are that it seems to capture key aspects of the complex, ‘amorphous’ construct of environmental orientation or ecological worldview, the reliability and validity of this scale are well established in the field of environmental education research (Dunlap et al., 2000), and it has been used in numerous studies over the past two decades. Despite the uncertainty in definition as to what to call the phenomenon being measured, the scale’s Likert statements seem to get at a person’s “beliefs” about humanity’s relationship with Nature that are of primary concern in this study.

In studies that have attempted to measure pro-environmental behavior, often the behavior measure is a self-report that has been created around the behavioral elements a course or program is emphasizing, and is therefore specific to that study. One of the more recent ways of measuring “pro-environmental” behavior is through an ecological footprint survey, which has become more common as people have become concerned with personal impact on the environment. For this study, several of these “ecological footprints” were located on the internet, most of which are geared towards adults; however, because the study participants are high school students, a survey was needed that was appropriate to students who are living at home and who do not have control over many household decisions. The Zerofootprint: Kids Calculator (www.zerofootprintkids.com/kids_home.aspx) was chosen for use in this study because it
Appendix A (continued)

provides a thorough range of questions geared towards children still living at home—many questions are focused on behaviors that a child could feasibly change, such as turning off lights, computer, television, etc. Validity for this instrument was established by consulting other experts in the field to review the survey, and monitoring how the survey was being perceived and understood during initial classroom visits during the administering of the survey. Because of confusion regarding the choices on one of the questions, it was eliminated from the final results for the survey.

The Zerofootprint: Kids Calculator has not been used previously for research, so it is important to consider the reliability of this instrument as well. In terms of establishing test-retest reliability, there were 30 questions on the behavior survey given to the students; however, only 15 of them were actually elements that a high school student could feasibly change. For example, questions asking about whether or not the student has a pool, how many loads of laundry the family does, etc, were unlikely to change. The 15 potentially changeable items were regarding things such as turning off lights/computer/television, recycling, how a student traveled to school, etc. By correlating the 14 “non-changeable” items on the pre- and post-tests for all students, it was possible to determine the reliability of the survey, which was 0.752, p<0.05. The 15 “changeable” items were used to calculate the ecological footprint of each student on the pre- and post-tests.

Methods and Procedures

Survey data was collected at the beginning and end of semester-long Environmental Science courses in 8 public high schools in the Northeastern United States
to measure the change in students' environmental attitudes and behaviors over the course of the semester. The data from each classroom was analyzed for significant differences with a control class at each school using independent t-tests, and a multiple regression analysis was performed on the data to determine a model of best fit to predict whether or not change was likely to occur for students.

**Participants**

Environmental Science teachers were contacted at 35 high schools in New Hampshire in order to find willing participants for this study. The main inclusion/exclusion criteria that were used for this study was the course had to spend at least 50% of the time focused on the items listed in the *NAAEE (North American Association for Environmental Education) Excellence in Environmental Education Guidelines for Learning (Pre K-12)* guidelines for 9-12th grade (revised 2004), which were estimated by the teacher during an initial interview. These *Guidelines for Learning* are one of the only "standardized" documents in the field of Environmental Education for what should be taught at varying grade levels (available at www.naaee.org/npeee/learner_guidelines.php). Each course also had to be a semester long elective course, as opposed to a full year, to allow for consistency among the classes and the given data collection period.

After receiving responses from the contacted teachers, 10 teachers at 8 different high schools were briefly interviewed and asked to provide the contact information for another teacher in the Science department who was not teaching an environmentally-related course, preferably with the same grade and ability level students, who might be
willing to have his/her students participate as the control class. The comparison group, according to Light et al. (1990), should be "composed of people who are similar to the people in the treatment group in all ways except that they did not receive the treatment" (p. 106). Essentially, the control group for this study should be students that are as similar to those in the Environmental Science elective course as possible, but who are not experiencing the "treatment." Since the Environmental Science elective courses tend to be mixed grade (10,11,12) and mixed ability, the ideal control class was also a mixed grade, mixed ability elective course. However, in several schools \(n=3\) it was not possible to find an elective teacher willing to participate as the control, so a non-environmental required course, such as Physics, was used as the control course. It was required that the control class was also in the science department and that most students who were enrolled in the control class were not also enrolled in the Environmental elective. The few students who were in both classes were discounted from the results. Additionally, it was required that the control class be taught by a different, "non-Environmental Science" teacher because a teacher with an environmental background would likely discuss environmental topics during the course. In order to ensure the lack of environmental topics being discussed in the class, the teacher was asked the same question as above regarding how much of the class is spent on items in the NAAEE standards. The answer had to be in the range of 0-5% in order for them to qualify as a control class. Interestingly, some schools have two levels of Environmental Science electives, such as Honors and regular—either level may be included in the study, but the
control class was required to have similar level students. In other words, the control for the Honors elective was another Honors course.

The pre- and post-surveys were given to students (N = 152) with 10 different Environmental Science teachers at 8 different public high schools. The 10 courses all meet the criteria discussed above, but the range of NAAEE standards discussed in each course ranges from 50% to nearly 100%, raising some question as to the comparability of these courses. Pre- and post-test data has also been collected from students (N = 105) in 8 “non-environmental” science courses, one class at each school. Although the control class was always that of a different “non-environmental” science teacher with less than 5% environmental content in the course, often he/she was not teaching an elective course as mentioned above, and the ability levels/grades did not match up exactly with those in the Environmental Science class, although there was often significant overlap. For example, it was common that the Environmental Science class was mixed grade (10-12th) and mixed ability (special needs, regular, and Honors), whereas the control class may have been an 11th grade regular Physics class. The reason for the imperfect matching was that it was much more difficult to find control teachers. The solution to remedying potential mismatches was to determine whether there was a significant difference in average age of the students in each pair and then to determine whether age was indeed a significant predictor of whether or not change occurred in individual students.

**Procedure**

Pre-test survey data were collected at all schools during the first three weeks of the Spring Semester 2009 and post-test data were collected during the last two weeks of
semester. Seven of the eight schools were on a two semester system, whereas the
eighth school was on a trimester system. Data were collected during the second trimester
at this school. Identical surveys were distributed to students by the researcher for the pre-
and post-survey and it took approximately 15 minutes for students to complete the
survey. The post-survey included an additional section of questions that asked students
about their environmental background and asked them to rate the class and their
perception of their own environmentalism.

**Survey Instrument**

The same pre- and post-test survey was given to all students, and consisted of two
sections: 1) 15 Likert-type questions scored from 1-5 (5 being the most proenvironmental
orientation) from the New Environmental Paradigm (NEP) scale that measure
environmental attitudes (views about humanity's ability to upset the balance of nature,
the existence to limits of growth for human societies, and humanity's relationship with
the rest of nature), and have been previously tested for validity and reliability (Dunlap et
al., 2000); and 2) 30 questions from the Zerofootprint: Kids Calculator, an “ecological
footprint” whose language has been modified for appropriateness for 10-12\textsuperscript{th} grade
students in order to provide information regarding students' environmental behavior
(scores range from 3-37 utilizing the 15 “changeable” items on the survey). The behavior
scale has the lowest score indicating the least impact on the environment, while a high
score indicates a relatively larger “ecological footprint.”
Data Analysis

The data analysis for this study consisted of three parts, (1) independent sample t-tests to determine in which classes a statistically significant change occurred in students’ attitude and/or behavior scores on the survey compared with the control class; (2) an initial multi-level analysis to determine whether classroom level variables were accounting for a significant amount of the variance in the outcomes, and (3) a multiple regression analysis to determine which student level variables could be used to predict the outcome of change in environmental attitudes or behaviors of the students. The variables of interest, which could be assessed at the student level or classroom level, include expected grade in the class, age, gender, grade in school, pre-test survey results, student rating of female/male guardian’s level of environmentalism (on a 1-10 scale), female/male guardian’s level of education, student rating of teacher’s influence on his/her environmental attitude, student rating of teacher overall, student rating of his/her enjoyment of the class, and student rating of his/her engagement in the class. Data for these final six categories were collected with additional questions on the post-test. Variables were also tested for interactions, as it is likely that variables such as students’ age, engagement in class, or rating of their teacher, may produce varying levels of change in students’ environmental attitudes or behaviors.

Results

Descriptive Statistics

Table 1 summarizes the descriptive statistics for pre- and post-test survey results, as well as for the outcome variables in this study, which are the change in students’
environmental attitude and behavior scores from pre- to post-test. For the environmental attitude survey, results on the pre-test ranged from a mean of 1.20 to 4.93 on a scale of 1 to 5 (5 being the most pro-environmental) with an average score of 3.54. Results on the post-test ranged from a mean of 1.27 to 4.93 with an average score of 3.5331. On the environmental behavior survey, students' scored between 8 and 35 on the pre-test with an average score of 19.20, and between 3 and 36 on the post-survey with a mean of 18.62. Results show that the mean difference in attitude scores between the pre- and post-surveys for the Environmental Science classes was 0.014 with a range of -1.60 to 3.00, indicating that the change in students' scores varied considerably from decreasing the pro-environmental attitude score by 1.6 points to increasing their score by 3 points, a large increase on a 1 to 5 scale. The mean difference in attitude scores for the control classes was -0.0414 with a range of -1.07 to 0.73, a much smaller range than was observed in the Environmental Science classes. The behavior data showed that on average, students in an Environmental Science course decreased their "ecological footprint" by 0.7346 points, representing a range of -14.5 to 9, while those in the control class decreased their score on average by 0.3661 with a range of -9.83 to 6. The multiple regression analysis below will explore several of the factors that may be contributing to the variation in the data.

Initial correlational analyses have also shown that the difference in students' attitudes and behaviors can be correlated with their pre-attitude and pre-behavior scores. The Pearson correlation for the attitude survey was $r = -0.19$, $p < 0.10$ for students in the control classes, but increases to $r = -0.41$, $p < 0.001$ for students in the Environmental
Science courses, indicating that this relationship is enhanced for students in these courses. The correlation is \( r = -0.21, p < 0.05 \) for the pre-behavior survey and the difference in mean behavior score between the pre- and post-survey for students in an Environmental Science elective course and \( r = -0.24, p < 0.05 \) for students in a control class, suggesting a moderate relationship between these factors for all students.

Figures 1 and 2 are descriptive graphs showing a comparison of the outcome means of Environmental Science and control classes when the students are divided into subgroups of low, medium, and high scores on the pre-survey (each group representing a range of +/- 2 SD). One-way ANOVA results indicate that the differences in the means between the groups for the Environmental Science classes are statistically significant, \( F(2,150) = 25.39, p < 0.001 \) for the attitude survey. Figure 1 shows that students who had the least "environmental" scores on the pre-survey (between 2 and 3) were the most likely to show a significant difference in their attitude scores. This finding suggests that students with lower environmental attitude scores are more likely to have a positive attitudinal response while taking an Environmental Science course.

One-way ANOVA results indicate that the mean differences in the pre- and post-survey behavior data for the low, medium, and high scoring groups (each group representing a range of +/- 2 SD) within the Environmental Science classes were significant at the \( p < 0.10 \) level \( (F(2,150) = 2.57) \). Figure 2 indicates that students who have a higher "ecological footprint" on the pre-behavior survey were most likely to reduce their ecological footprint over the course of the semester. The students scoring at the higher end of the scale were likely to decrease their score by two points (-2.27) on average if
they were in an Environmental Science class compared with only one point (−1.03) on average if they were not. Therefore, this finding suggests that those students who enter Environmental Science courses with a higher "ecological footprint" are most likely to benefit from the course in terms of changing their environmental behavior. The pre-attitude and pre-behavior scores are also used as predictors in the multiple regression model presented below.

**Mean Differences Between Environmental and Control Classes**

The mean differences when we compare the Environmental Science and the control class at the individual schools separately with independent sample *t*-tests are informative because each school has a unique population of students, teachers with different teaching strategies, and different emphases in the content of the course. This analysis shows that only two of the ten Environmental Science classes (Figure 3, teacher 4: *t* = 1.82, *p* < 0.10; teacher 5: *t* = 3.59, *p* < 0.001) showed a statistically significant change in students' environmental attitude compared with the control class at their school, while two other classes (teachers 6 and 10) also showed an increase in students' pro-environmental attitude scores; however, this change was not statistically significant. Two Environmental Science classes showed a statistically significant change (Figure 4, teacher 1: *t* = -2.29, *p* < 0.05; teacher 10, *t* = -2.37, *p*<0.05) in students' pro-environmental behavior, resulting in students reducing their ecological footprint by a mean of 1.65 (teacher 1) to 5 points (teacher 10). Teachers 2, 5, 7, and 9 also had students who on average reduced their ecological footprint, but the score difference was not significant due to a low sample (N) number in the classes, or an insignificant disparity.
with the control class. Overall, there were more classes that show an improvement in students' pro-environmental behavior than their pro-environmental attitudes. These results suggest that the change in students' attitudes and behaviors, while they do have a significant relationship with a Pearson correlation of \( r = -0.34, p < 0.001 \) for all students, and \( r = -0.40, p < 0.001 \) for students in the Environmental Science elective courses, they are only moderately associated with one another. Teachers, therefore, can be more or less successful at affecting the attitudes and behaviors of the same students. This finding supports that of prior research investigating the relationship of the NEP scale and proenvironmental behavior (Dunlap et al., 2000; Gardner & Stern, 1996).

**Multi-Level Model (Hierarchical Linear Model)**

Another significant issue to consider is that this study design involves higher order units of classrooms within which the participants are nested. Shadish, et al (2002) point out that in this situation “treatment conditions are then totally confounded with classrooms, making it impossible to tell if performance differences at posttest are due to differences in treatment or in classroom characteristics, such as the charisma of the teacher, the mix of students, or the physical conditions of the class” (p. 255). A solution for this issue is to model the effects of the data by using a *hierarchical linear model*, or *multilevel model*. This allows for the calculation of variance that is due to intraclass variance and the amount that is due to interclass differences, thereby allowing for analysis of both student level and classroom level data.

In order to determine if a multi-level model would be necessary for this analysis, a fully unconditional model was tested in order to determine the *intraclass correlation* or
Appendix A (continued)

ICC, which is defined as \((\tau_{00}/(\tau_{00}+\sigma^2))\), where \(\tau_{00}\) is the interclass variability and \(\sigma^2\) is the intraclass variability (Hayes, 2006). This is a model without any predictors which focuses on whether differences exist, on average, between the level-2 units (classes in this case) on the outcome variable (change in environmental attitudes or behaviors) (Hayes, 2006). The ICC gives the percentage of variance in outcome that is accounted for by differences between class averages, and the results of this analysis show that \(\tau_{00}\), the interclass variability, was found not to differ significantly from 0 for either of the models, whereas \(\sigma^2\), or the intraclass variability, was 0.26 for the difference in environmental attitudes and 14.41 for the difference in environmental behaviors, both significant at the p<0.05 level. Therefore, the ICC is not significantly different from 0 for either of the models, indicating that the variance can be explained by level-1 predictors, and it is not necessary to proceed with a multi-level model to account for level-2 differences.

**Multiple Regression Analysis**

After the above analysis was performed, it was necessary to perform a multiple regression analysis to determine the level-1 variables that were accounting for the variance in the outcomes. Several variables were initially tested for bivariate correlations with the outcomes of difference in environmental attitude and difference in environmental behavior. The variables that were tested include expected grade in the class, age, gender, grade in school, pre-test survey results, student rating of female/male guardian’s level of environmentalism (on a 1-10 scale), female/male guardian’s level of education, student rating of teacher’s influence on his/her environmental attitude, student
rating of teacher overall, student rating of his/her enjoyment of the class, and student rating of his/her engagement in the class. Significant findings for the outcome variable difference in environmental attitude included pre-test survey results ($r = 0.30, p < 0.001$), student rating of teacher overall ($r = 0.25, p < 0.01$), and significant finding for the outcome variable difference in environmental behavior included pre-test survey results ($r = -0.21, p < 0.05$), student rating of his/her engagement in the class ($r = -0.21, p < 0.05$), student rating of mother's environmental level ($r = -0.19, p < 0.05$), and age ($r = -0.15$) and student rating of his/her enjoyment of the class ($r = -0.14$) were significant at the $p < 0.10$ level.

Accordingly, each of the above variables was added one at a time to a multiple regression model for each of the outcomes. The resulting models are summarized in Table 2 for difference in environmental attitudes and Table 3 for difference in environmental behaviors. Table 2 shows the three models tested for the outcome difference in environmental attitude (DIFFAT), in which Model 3, including the predictor variables for the pre-test attitude score (PreAT) and the student rating of the teacher overall (TEACHOV) with an interaction term for these two variables, can be seen to account for 23.9% of the variance in the outcome variable. The Model 3 equation is as follows: $\text{DIFFAT} = -2.27 + 0.50\text{PreAT} + 0.40\text{TEACHOV} - 0.10(\text{PreAT} \times \text{TEACHOV})$. The significant interaction means that a different relationship exists between the predictor variable, pre-test attitude score, and the outcome variable for different levels of the predictor variable, teacher overall (Figure 5). For example, when a student gives a teacher a low rating, then the effect size between pre-test attitude score and the outcome variable,
difference in environmental attitude, is moderately positive (0.50). However, for a medium rating of a teacher the relationship moves closer to zero (0.03); and if a student rates the teacher highly, then the relationship becomes moderately negative (-0.45). This therefore indicates that a student with a high opinion of the teacher (R = 7-10) is more likely to improve her environmental attitude the lower she scores on the pre-survey. If a student strongly dislikes the teacher (R=0-3), then it is unlikely that the student will improve her attitude score unless she has scored very highly on the pre-test attitude survey. Finally, for a student with a mediocre opinion of the teacher (R=4-6), the class is not likely to have a large impact on his or her environmental attitude. Interactions of other variables were tested, including age and pre-test attitude score, but none were found to be statistically significant.

Table 3 indicates that the model accounting for the most variance ($R^2=0.166$) is Model 4, which includes the predictor variables pre-test behavior score (PreBEH), student rating of his/her engagement level in the class (ENG_INV), and student rating of his/her female guardian’s environmental level (ENVFG) with age being controlled for. The equation for this model is:

$$\text{DIFFBEH} = 21.13 - 0.23\text{PreBEH} - 0.46\text{ENG_INV} - 0.42\text{ENVFG} - 0.67\text{Age}$$

Interactions were tested between each of the variables in this model with no significant results. The predictor variable of student rating of his/her enjoyment of the class was also added to the model, but was not found to be significant. Model 4 indicates that when age is controlled for, an increase in a student’s pre-test behavior score significantly predicts a decrease (or improvement) in the student’s post-test behavior score. This means that
students that enter the Environmental Science course with a larger ecological footprint are more likely to improve their behavior score. Additionally, an increase in the student’s rating of their engagement level in the class (1-10 scale) significantly predicts that the student’s ecological footprint, or behavior score, will decrease (or improve). Therefore, perhaps not surprisingly, a student that feels more engaged in the class is more likely to improve his or her environmentally-related behavior during the course. Finally, an increase in a student’s rating of his/her female guardian’s environmental level significantly predicts a decrease (or improvement) in his/her ecological footprint. Interestingly, because it is necessary to control for age and the coefficient in the final model is -0.67, this means that an increase in the age of a student indicates that he/she is more likely to improve his/her behavior score.

Discussion and Implications

As more high schools are introducing the Environmental Science elective course into their curriculum (Edelson, 2007), it has become necessary to investigate the role these courses are playing in shaping adolescents’ attitudes and behaviors towards the environment. If the goals set forth in the Belgrade Charter to create an environmentally literate citizenry are to be achieved, then we must determine how our secondary schools can help forward this agenda. The results of this study show that some Environmental Science elective courses are more effectively improving the environmental attitudes and behaviors of students than others. It is also evident that whether change occurs for each individual student can be partially predicted by the pre-test scores of the student, in addition to the student’s overall rating of the teacher and engagement level in the course.
These findings have important implications for the population for whom we are targeting for participation in Environmental Science courses. For example, the results suggest that students with the least pro-environmental attitudes and behaviors are the ones who stand to benefit the most from taking this type of course. In many schools, students who are taking the Environmental Science course are taking the course as an alternative to another science course which is perceived to be more difficult. To the extent that many of these students are lower level students who do not come from environmentally active homes, the course is reaching a beneficial population. This is an important finding for schools as it indicates that Environmental Science courses are reaching students that stand the most to gain from this type of course.

Interestingly, several classes had a negative impact on students' environmental attitude. It is important to discuss the negative impact that appears to result for these students. Any student whose attitude score goes down could be the result of several causes. One possibility is that these students come into the course with a "naïve" environmental worldview based on little depth or experience with the subject matter. They therefore tend to answer the Likert-type questions in the "strongly agree" or "strongly disagree" categories on the pre-attitude survey. After taking the course, their views have now been complicated as they have been exposed to the complexities of the issues, and as a result are now less sure in their views. This therefore could be an indication of a more sophisticated level of thinking about the subject, but this hypothesis needs to be further explored. If so, this has interesting implications for interpretation of the NEP scale.
because the highest score may not be reflective of the most in-depth pro-environmental values.

Another possibility is that students disliked the class or the teacher, and were negatively impacted by the teacher’s approach. Although results from the multiple regression analysis show that the students’ rating of their teacher is a significant factor in determining whether positive change in environmental attitude occurs for each individual student, the mean teacher rating for the class does not seem to exhibit such a correlation as the only teacher in Figure 3 with an average rating below 8.3 was teacher number 3 (R=6.9). These high overall teacher ratings suggest that this is not the reason for the decrease in attitude scores among many of the students.

In relating environmental attitudes and behaviors, this research confirms previous findings that environmental attitude scores, as measured by Dunlap’s NEP scale, can be correlated with environmental behaviors (Dunlap et al., 2000; Gardner & Stern, 1996) with a correlation of 0.40 found in this study. Therefore, it is possible for teachers to be more or less successful at influencing the environmental attitudes or behaviors of their students depending on their teaching strategies. By studying in more depth the classrooms of teachers whose students are making improvements in their pro-environmental attitudes and behaviors, it may be possible to begin to determine the most effective teaching strategies for bringing about these desired outcomes.

The third research question asks about differences at the classroom level that may be contributing to change in students’ environmental attitudes and behaviors. However, initial multi-level analyses show that classroom level differences do not significantly play
a role for either of the outcomes. Therefore, it can be assumed that the variance in the outcomes is due to student level variables, such as those determined to be significant in this study. This finding was surprising given that there were considerable differences between the Environmental Science elective courses. For example, there is no standard curriculum for Environmental Science elective courses, often resulting in a curriculum that reflects teacher and student interest. In addition, some courses provide an overview of issues with a more interdisciplinary focus, often called “Environmental Science,” while other courses are focused on a particular aspect of the environment or field research, ranging from Marine Biology to Ornithology to Field Biology. Within all these courses, there are also major differences in time spent outdoors, emphasis on debate and discussion, reflective activities such as journaling, etc. As noted earlier, the Environmental Science courses in the study sample varied from 50% to 100% in the amount of the NAAEE Guidelines for Excellence covered during class. Given all these differences between the classes, although classroom level variables were not found to be significantly accounting for the variance in the outcome variables, it is recommended that future studies continue to investigate the effects of these differences between classes on the environmental learning of students. Further studies are also needed to determine other student-level factors, such as student’s achievement level in the course, socioeconomic status, environmental identity, student openness and willingness to critically reflect, that may be further influencing the likelihood of change occurring for students.
One limitation of this study is related to the choice of control classes in the study sample. It was noted earlier that it was difficult to find control classes that were ideal matches for the Environmental Science class at each school in grade and ability level. In order to ensure that differences in mean age between Environmental Science and control classes were not confounding the results, the mean ages of the pairs were compared. Five class pairs were found to have a non-significant difference in the average age of the students, whereas five class pairs (Numbers 1-5 on the graphs in Figure 3 and 4) did have a significant difference in the average age of the students, in each case with the Environmental Science course having students approximately one year older on average than the control class. In the multiple regression analysis, age is not found to be a significant factor in predicting the change in attitude score of students; however, it is found to be significant (at the p < 0.10 level) in the prediction of a change in behavior score of students. Therefore, this difference in mean age between the courses could lead to an overestimate of the effect in comparing the behavior scores of these classes (but should not affect the attitude results), and should be taken into consideration.

A final limitation is that although the results indicate that students’ engagement level in the course and overall rating of the teacher are important indicators as to how they will be affected by the Environmental Science course, this study did not investigate what factors in the classroom setting account for this result. Further research needs to be done to determine which characteristics of the teacher-student relationship promote this respect, as well as which topics and types of activities are most engaging for students in an Environmental Science course at the high school level. This study lays the foundation for
continued progress in determining the best practices of educating students in Environmental Science courses as they serve as conduits for promoting change in students' environmental attitudes and behavior.

References


Table 1

*Descriptive Statistics for Pre- and Post-Test Environmental Attitude and Behavior Data*

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<td>Env Sci</td>
<td>153</td>
<td>-0.74 (3.94)</td>
<td>-0.68 (.20)</td>
</tr>
<tr>
<td>Control</td>
<td>104</td>
<td>-0.37 (2.97)</td>
<td>-0.14 (.24)</td>
</tr>
</tbody>
</table>

*Note.* Difference in Attitude indicates the difference between pre- and post-test attitude scores; Difference in Behavior indicates the difference between pre- and post-test behavior scores; Env Sci indicates the combined Environmental Science classes.
Figure 1. Mean difference in environmental attitude scores between pre- and post-test surveys for each of three categories of pre-test attitude scores, including low, medium, and high scores. ANOVA results show statistically significant differences between the categories for the Environmental Science classes. Students that score in the lowest range (2-3) on the pre-test are most likely to increase their environmental attitude score from pre- to post-test.
Figure 2. Mean difference in environmental behavior scores between pre- and post-test surveys for each of three categories of pre-test behavior scores, including low, medium, and high scores. A high score (25-35) indicates the least pro-environmental behavior on the pre-survey, while a decrease in mean difference indicates an improvement in pro-environmental behavior during the semester. ANOVA results show statistically significant differences between the categories for the Environmental Science classes. Students that score in the highest range (25-35) on the pre-test are most likely to improve their environmental behavior score from pre- to post-test.
Appendix A (continued)

Figure 3. Mean difference values representing pre-test attitude survey data for students in each class subtracted from the mean post-test attitude score for students in that class. Differences for students with each teacher are compared with the difference for the corresponding control class at the same school. Statistically significant differences between the Environmental Science class and control classes were found for teachers 4 and 5, with teachers 6 and 10 also showing improvement in students’ environmental attitudes during the semester.
Figure 4. Mean difference values representing pre-test behavior survey data for students in each class subtracted from the mean post-test behavior score for students in that class. A negative difference is interpreted as a reduction in students’ ecological footprint, which represents an improvement in environmental behavior. Differences for students with each teacher are compared with the difference for the corresponding control class at the same school. Statistically significant differences between the Environmental Science class and control classes were found for teachers 1 and 10, with teachers 2, 5, 7, and 9 also showing improvement in students’ environmental behaviors during the semester.
Figure 5. For teacher rating levels low, medium, and high, pre-test attitude scores as a function of predicted difference in attitude scores from pre- to post-test. Students that rate the teacher highly are most likely to improve their attitude scores if they score at the lower end of the environmental attitude scale (from 0-5). Students that rate the teacher at the medium level or below are not predicted to improve their environmental attitude score during the semester.
Table 2

Multiple Regression Models for Difference in Attitude Outcome

<table>
<thead>
<tr>
<th>Predictor</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.30***</td>
<td>.56*</td>
<td>-2.27*</td>
</tr>
<tr>
<td><strong>Predictor:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test Attitude</td>
<td>-36***</td>
<td>-32***</td>
<td>.50†</td>
</tr>
<tr>
<td>Teacher Rating</td>
<td>.07***</td>
<td>.40***</td>
<td></td>
</tr>
<tr>
<td><strong>Interaction:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test Attitude x Teacher Rating</td>
<td>-10**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total $R^2$</td>
<td>.17</td>
<td>.20</td>
<td>.24</td>
</tr>
<tr>
<td>Error df</td>
<td>152</td>
<td>149</td>
<td>149</td>
</tr>
</tbody>
</table>

†$p<0.10$, *$p<0.05$, **$p<0.01$, ***$p<0.001$

Table 3

Multiple Regression Models for Difference in Behavior Outcome

<table>
<thead>
<tr>
<th>Predictor</th>
<th>M1†</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2.43†</td>
<td>7.30***</td>
<td>9.44***</td>
<td>21.13**</td>
</tr>
<tr>
<td><strong>Predictor:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test Behavior</td>
<td>-.16*</td>
<td>-.20***</td>
<td>-.24***</td>
<td>-.23**</td>
</tr>
<tr>
<td>Student Engagement</td>
<td>-.53***</td>
<td>-.44**</td>
<td>-.46***</td>
<td></td>
</tr>
<tr>
<td><strong>Predictor:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female Guardian</td>
<td></td>
<td></td>
<td>-.40*</td>
<td>-.42**</td>
</tr>
<tr>
<td>Environmental Rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control Predictor:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td>-.67†</td>
</tr>
<tr>
<td>Total $R^2$</td>
<td>.04</td>
<td>.11</td>
<td>.15</td>
<td>.17</td>
</tr>
<tr>
<td>Error df</td>
<td>152</td>
<td>149</td>
<td>149</td>
<td>149</td>
</tr>
</tbody>
</table>

†$p<0.10$, *$p<0.05$, **$p<0.01$, ***$p<0.001$
Appendix B: IRB Documentation

University of New Hampshire
Research Conduct and Compliance Services, Office of Sponsored Research
Service Building, 51 College Road, Durham, NH 03824-3585
Fax: 603-862-3564

23-Jan-2009

Blatt, Erica
Education, Morrill Hall
12 Twombly Street
Dover, NH 03820

IRB #: 4453
Study: A Sociocultural Approach to Transformative Learning in an Environmental Science Classroom
Approval Date: 21-Jan-2009

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as Expedited as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 110.

Approval is granted to conduct your study as described in your protocol for one year from the approval date above. At the end of the approval period, you will be asked to submit a report with regard to the involvement of human subjects in this study. If your study is still active, you may request an extension of IRB approval.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the attached document, Responsibilities of Directors of Research Studies Involving Human Subjects. (This document is also available at http://www.unh.edu/osr/compliance/irb.html.) Please read this document carefully before commencing your work involving human subjects.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or julie.simpson@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,

[Signature]
Julie F. Simpson
Manager

cc: File
Abrams, Eleanor