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Service Learing: An Appropriate Approach to Environmental Education
(Under the Direction of RON CARROLL)

This thesis explores the appropriateness of the service learning approach to environmental education. Service learning is a form of experiential education where students are encouraged to apply classroom concepts in addressing community needs. My thesis begins with a brief definition, history, and modern day account of environmental education. A discussion of service learning as a pedagogy and philosophy follows. I then describe a freshman seminar on water quality which employed the service learning pedagogy. This seminar served as a case study from which to evaluate this pedagogy. Qualitative and quantitative data is presented. Finally, I identify ways in which service learning can be implemented in existing courses and offer suggestions for future research.

INDEX WORDS: Service Learning, Environmental Education, Altamaha Watershed, Water Quality, Freshman Seminar

SERVICE LEARNING:

AN APPROPRIATE APPROACH TO ENVIRONMENTAL EDUCATION?

by

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B.A., Rhodes College, 1999

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2001

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August 2001

DEDICATION

In memory of Robert Cleveland Dunlap (‘32) for his unconditional support and love.

ACKNOWLEDGEMENTS

I would like to express my gratitude to all individuals associated with the various stages of my graduate program. Elizabeth Pate has provided continual direction, feedback, and support throughout my graduate career. She has been instrumental in my professional growth and success. My gratefulness to her is immeasurable. Additionally, I thank Ron Carroll and Laurie Fowler for their encouragement, flexibility, support, and helpful suggestions. Most of all, I would like to thank the students that participated in my study. They have contributed greatly to both my professional and personal growth. I sincerely appreciate Kevin Hoth for his enduring spirit and commitment to the study's resulting service project. I am also grateful for the assistance of James Holland of the Altamaha Riverkeeper, Mac Rawson of the Georgia Sea Grant Program, and the University of Georgia's Office of Public Service and Outreach. Without their support, this study would not be possible.

I also want to thank my family. Their confidence and commitment in me has enabled me to follow my passions and contribute to my community in ways few people enjoy. I will always be indebted to them. Lastly, I thank my friends, especially Trent Pingenot, for allowing me to follow my passions and supporting me every step of the way.

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CHAPTER 1

INTRODUCTION

Human impact on Earth's land, water, and atmosphere is evident at the local, regional, and global levels. Overpopulation, energy production and consumption, depletion of natural resources, and pollution are among some of the environmental problems facing us today. These problems often involve a mix of ecological principles, human behavior and values, politics, and additional issues that add to their complexity. However, armed with the proper tools, citizens need not find these issues overwhelming. Instead, citizens can identify their responsibility in sustaining and caring for our planet with more ease. This is the notion of stewardship.

Environmental education is one tool that helps to promote responsible stewardship. Environmental education equips students and citizens alike with a general understanding of the concepts that underlie environmental problems. In addition to exposing students to the fundamental principles of ecology, environmental education can assist in protecting the earth's nonrenewable resources and critical ecological processes through student awareness.

Educational institutions are beginning to acknowledge the role of environmental education as an investment in our future. Schools, community colleges, and research universities now offer environmental courses in the form of introductory and upper level courses, internships, and noncredit experiences. Instructors may rely on traditional, experiential, or other educational approaches to effectively convey general environmental knowledge to enrolled students. Service learning, a type of experiential education that advocates the use of applied knowledge in addressing community identified problems, may present an appropriate approach to environmental education. Championed by practitioners as a means of addressing a student's intellectual, personal and interpersonal

growth, service learning may offer a more engaging and practical course design that conveys the natural, social, political, and ethical facets of environmental issues.

As both a pedagogy and a philosophy, service learning offers an innovative educational approach that encourages students to bridge classroom-taught concepts with community service. Researchers claim that service learning results in academic impacts such as demonstrated complexity of understanding, problem analysis, critical thinking, and cognitive development (Batchelder & Root, 1994; Eyler & Giles, 1999). In addition to academic impacts, service learning has been shown to foster student leadership, communication skills, moral development, and personal efficacy. These acquired skills may help students understand the natural, social, and ethical complexities that underlie environmental issues. In addition, service learning may equip participating students with the social and personal skills necessary to address issues that impact a variety of people on a variety of levels.

Perhaps service learning coupled with environmental education is a means to reach the ends of an enlightened and environmentally responsible citizenry. Perhaps not. This study will address the question of whether or not service learning is an appropriate approach to environmental education.

The following chapters address the above research question. In Chapter 2, environmental education is further defined. The definition, pedagogical components, and history of service learning are presented. This chapter provides examples to illustrate environmental service learning courses at colleges and universities throughout the United States. Chapter 3 presents the methodology for this study. It outlines the seminar developed and implemented to begin addressing the research question. Chapter 4 presents the results produced from the study. Chapter 5 discusses the implications of the study and resulting data on academia and the community. The chapter closes with suggestions for future courses and research.

CHAPTER 2

LITERATURE REVIEW

This chapter will establish a framework from which to address the question of whether or not service learning is an appropriate approach to environmental education. This background information will introduce the reader to the important topics addressed throughout this study. The chapter will begin with a working definition and historical perspective of environmental education. The definition, pedagogical components and philosophy of service learning will follow. The chapter will conclude with examples of environmental education service learning courses in higher education.

Environmental Education

Environmental education introduces students to the fundamental principles of applied ecology. It explores the principles of ecosystem functions, energy flow, living organisms, and the physical environment (Raven & Berg, 2001). These fundamental principles equip students with the tools for which to understand our changing environment. For instance, basic knowledge of earth's climate and the implications of physical and chemical changes within the atmosphere allow students to better understand and address the threat of global warming. Knowledge of nutrient cycling within ecosystems allows students to understand how human activities have influenced nutrient availability. And, an understanding of biological communities and their relationship to a non-living environment can highlight the impacts of human caused habitat fragmentation.

Over the years, the case for environmental education has grown exponentially. The support for environmental education has been in response to the increasingly disturbing reality of our current environmental situation. The times of abundant resources and life-sustaining services such as clean air and water seem to be diminishing. Dire issues such as population growth, diminishing resources, clean water shortages, and

desertification require urgent attention from a knowledgeable public receptive to addressing them.

Historically, there was little reason to consider environmental issues. Plentiful resources and small populations perpetuated a consumptive approach for many. The colonization of America illustrates this reality. In the 16th century, early European settlers came to the new world with specific notions about land tenure, land use, and government's role in land matters. In general, Europeans harbored strong feelings of stewardship and practiced conservation measures to maintain land resources. These values developed from centuries-old feudal relationships established in law to counter the realities of an England abundant in people but scarce in land (Kundell, 1989).

In the new world, colonists found a different environmental reality. Land, forest, and game were abundant in America yet people were not. America's situation did not appear to warrant conservation. So, notions of stewardship and land conservation fell prey to a free-for-the-taking mentality (Kundell, 1989).

Today, few political and economic issues remain unscathed by environmental concerns. Local communities wishing to grow must now consider the cost of doing so. Although growth and development may provide the local hardware store with increased business, local taxes will be drained as infrastructure is expanded to accommodate migrating families. Valuable farmland and fertile soils may be lost to development pressures. Water quality and quantity may suffer.

On the global level, issues of trade and development are forced to consider environmental repercussions. Markets may open to free trade yet they also open up new lands to invasive pests, plants, and animals. Traveling via ship ballasts from foreign lands, the zebra mussel found a new home in the Great Lakes. Today, the zebra mussel has become so profuse that it clogs intake and effluent pipes and jeopardizes native mussel species.

Local and global decisions require considerations that span economic, political, and environmental realms. To counter the complex thicket of issues bombarding modern

day concerns, citizens must be equipped with the intellect to see beyond immediate issues and assess each layer sensitively, creatively, and holistically.

By its very nature, environmental education is an applied field. It is a study of the social, cultural, ecological, economic, and political realms of our natural world. Through environmental education, educators and students alike learn that today's environmental problems do not come equipped with a fixed answer. Instead, environmental education encourages the student to explore the thicket of issues involved in environmental problems and solutions.

Resistance Towards Environmental Education

Even though the case for environmental education has grown exponentially, it has not received the attention it requires. The environmental crisis we face today requires an ecologically literate society that is able to acknowledge and understand the links between humanity and its habitat. Unfortunately, our academic institutions have not kept pace with human-caused resource depletion, population growth, climate change, species extinction, acid rain, deforestation, ozone depletion, and soil loss. Today, these issues threaten human survival yet education proceeds at all levels as if an environmental crisis did not exist. Many current citizens and leaders embody this denial.

Academic institutions have been slow to accept environmental education as a part of its curriculum. This may be because environmental education challenges the traditional structure of academic institutions. Universities and colleges are separated by disciplines. Communication between departments is uncommon yet competition may be great. Despite similarities or overlap, disciplines largely remain physically and intellectually isolated, operating as independent cogs within a system.

Environmental education requires an interdisciplinary approach. The question of: "Why is a stream contaminated?" cannot be answered through the specialized expertise of one discipline. Instead, collaborators from an array of disciplines may raise questions such as:

- What pollutant is causing the stream to be polluted?
- What past and present land uses may be contributing to the pollutant?
- What are the acceptable levels for the pollutant?
- How might this pollutant impact aquatic and human life?
- Which laws exist to protect our waters?
- Do design parameters exist to protect streams like this one?

Only local citizens and experts can answer these inquiries. Historians, biologists, ethicists, botanists, politicians, lawyers, chemists, health experts, city planners, store owners, and others must be involved in determining a stream's water quality and the solutions necessary to address the impaired water. Since polluted streams do not occur in a vacuum, problem analysis and solution identification must not either. Without such an interdisciplinary and collaborative approach, environmental issues will be incompletely explained and will likely elicit resistance from excluded stakeholders.

An interdisciplinary approach is also necessary to stress the wholeness of environmental issues. David Orr (1992) eloquently states that: "To understand that our manner of living, so comfortable for some, is linked to cancer rates in migrant laborers in California, the disappearance of tropical rain forests, fifty thousand toxic dumps across the U.S.A, and the depletion of the ozone layer is to see the need for a change in our way of life. To see things whole is to see both the wounds we have inflicted on the natural world in the name of mastery and those we have inflicted on ourselves and on our children for no good reason, whatever our stated intentions."

Through an interdisciplinary approach, environmental education challenges students to explore the roots of our problems and not just their symptoms. With this in mind, is there an appropriate pedagogy, the science of profession of teaching, for environmental education? The service learning pedagogy may satisfy the discipline needs of environmental education.

Service Learning

Defined by Barbara Jacoby, service learning is an educational philosophy that recognizes the symbiotic relationship between service and learning, "a form of experiential education in which students engage in activities that address human and community needs together with structured opportunities intentionally designed to promote student learning and development". The term *community* here refers to local neighborhoods, surrounding towns, the state, the nation, and/or the global community. The phrase *human and community needs* refer to those needs addressed specifically by the community (1996).

The service learning pedagogy has been heavily influenced by the contributions of John Dewey. As an American philosopher and educator, Dewey believed that learning does not result from rote memorization and reproduction on demand. Instead, Dewey argued that "Nothing is really known until it has been understood" (Dewey, 1933).

One way to achieve understanding is through active application. If knowledge is to be accessible to solve new problems, then it is best used in a context where it is used as a problem-solving tool. To understand academic material is to be able to see its relevance to new situations. In other words, understanding is distinct from the ability to recall information when prompted by an exam. Understanding is the ability to recall knowledge when it is relevant to a new situation and the ability to implement it in that situation. In this case, material that is understood provides meaning for the learner (Eyler and Giles, 1999).

In the 1980s David Kolb developed an experiential learning cycle based on the writings of John Dewey and other experiential learning theorists. According to Kolb, effective learning includes four different kinds of learning that corresponds to four points within the learning cycle. First of all, the learner must grasp information via concrete experiences and abstract concepts. The learner "must be able to involve themselves fully, openly, and without bias in new experiences" (Kolb, 1981). He or she then makes the experience and information personally meaningful through reflection and observations.

From here, the learner must be able to create concepts that integrate their observations and reflections into logically sound theories. This process may result in perspective transformation. To complete the learning cycle, the individual applies these theories and experiments with their application through decision-making and problem solving (Schine, 1997; McEwen, 1996). Succinctly stated, the learning cycle proceeds as follows: "Immediate concrete experience is the basis for observation and reflection. An individual uses these observations to build an idea, generalization or 'theory' from which new implications for action can be deduced. These implications or hypotheses then serve as guides in acting to create new experiences" (Kolb, 1981).

Program Characteristics

In order for service learning to be recognized as a legitimate pedagogy, it must demonstrate its contributions to the cognitive and intellectual development of students in addition to emphasizing the personal and interpersonal growth of the student. To achieve the intellectual goals of higher education, including learning and application of material, critical thinking, problem solving and perspective transformation, a service experience alone is not enough. Instead, learning is achieved depending on how well theory and practice are integrated through application and reflection. Additionally, character development and perspective transformation are enhanced by the quality of diversity and community voice in service learning. Practitioners and surveyed students agree that placement quality, application, reflection, diversity, and community voice are key characteristics to successful service learning courses (Eyler and Giles, 1999). These are each considered next.

Placement quality refers to connecting productive situations for student learning with genuine resources useful to the community. It is the degree to which classroom taught concepts can be applied to identify community concerns. Academic connections are critical for success and if the service component does not complement classroom teachings, the learning may prove to be unproductive (Eyler and Giles, 1999).

Application refers to the degree in which students can connect their classroom learning to their experiences in the community and vice versa. Application appears to be the largest predictor of academic learning. Batcheldor and Root (1994) demonstrated the important link between application and learning in a study of college students. They found that students performed more sophisticated and complex analyses of a social problem when the problem was related to their service. Additional studies also demonstrated the relationship between application and critical thinking outcomes such as issue identification and the ability to see consequences (Eyler and Giles, 1999).

Reflection involves the careful scrutiny about an experience. It requires one to monitor one's own thinking processes and reactions (Eyler and Giles, 1999). In 1916, Dewey discussed the importance of reflection in learning from experience in Democracy and Education. Dewey believed that reflection is an intentional endeavor to discover specific connections between something we do and the consequences that result. Instead of discovering new information through trial and error, Dewey argued that reflective activities allowed for better problem solving and improved the effectiveness of learning (Dewey, 1916).

In the March 1991 edition of Educational Leadership, reflection was presented "as a promising practice that promotes the desire to change values and beliefs through internalization of knowledge and the development of skills through generalizing specific experiential events into generic patterns of problem solving" (Sparks-Langer, Mohlman, & Colton). In light of this definition, many of today's service learning practitioners employ reflection activities to promote learning about the social issues behind the needs to which a service is responding. This learning may include a deeper understanding of the historical, cultural, economic, sociological, and political contexts of the needs or issues being addressed.

Reflection in the form of writing or discussion compliments academic learning outcomes. Deeper understanding and better application of the subject matter and increased complexity of problem and solution analysis are two outcomes associated with

reflection activities. Reflection has also been shown to encourage openness to new ideas (Eyler and Giles, 1999).

Diversity involves student interaction with diverse ethnic, religious, gender, income, and age groups. Service learning practitioners define the goals for diversity differently. Some believe that diversity should lead to greater tolerance and understanding within the status quo. Others view the goal of diversity as social transformation which allows the contributions of others to challenge the status quo (Rhoads, 1998). Overall, research shows that diversity predicts both tolerance (assimilation view) and transformation (transformational view) (Eyler and Giles, 1999).

Community voice refers to the degree in which community needs are met. In service learning, those being served control the service provided. Community members define their needs and this guides the resulting service task. Student learning is therefore directly coupled with actual community needs rather than based solely on achieving desired student learning outcomes (Jacoby, 1996). When community needs are met, students demonstrate an appreciation and valuing of community goals (Eyler and Giles, 1999).

In addition to the program characteristics set out by Eyler and Giles the notion of *reciprocity* has been cited as another key component of successful service learning courses. The notion of reciprocity is intertwined with the notion of community voice. Here reciprocity refers to the mutual and engaged relationship that exists between the server and the person or group being served. When reciprocity exists, service learning is likely to foster a win-win situation where both the server and those served teach and learn. (Jacoby, 1996).

Researchers claim that through reciprocity, students develop a greater sense of belonging and responsibility as members of a larger community. Yet this sense of responsibility and respect are shared mutually between students and the community in the service learning exchange (Kendall, 1990). Service learning is therefore unique to the

traditional, paternalistic, one-way approach to service where one person or group has resources that they share with those who are viewed as lacking resources.

Philosophy

In addition to providing a pedagogy, service learning is a philosophy of "human growth and purpose, a social vision, an approach to community, and a way of knowing" (Kendall, 1990). It is through service involvement and acts of reciprocity that service learning is elevated to the level of philosophy.

The strong roots underlying service learning emanate from a number of educational, religious, and social welfare traditions. For instance, the basic teachings promoted by Judeo-Christian ethics such as "love thy neighbor" and "do unto others as you would have them do unto you" provide the values and principles for which service is based (Schine, 1997). In the mid 1900s, Dewey highlighted the implications for education and citizenship development and drew attention to the social orientation that service learning could encourage (Dewey, 1946). Even President John Kennedy challenged citizens to "…ask not what your country can do for you; ask what you can do for your country."

Westheimer and Kahne (1996) argue that there are two orientations supported through service learning activities: charity and change. Orientations are determined depending on the relationship that exists between the service provider and the recipient and the level of inquiry encouraged among service learning participants. Therefore, a different moral, political and intellectual domain marks each orientation.

Charity Orientation

Service learning activities that encourage 'charity' among its participants emphasize a moral domain of giving. Here, the objective is to counter the narcissism believed to be prevalent in today's society. Educators are challenged by politicians to foster a volunteer ethic that encourages youth to give back to their community and schools. Former President George Bush, an avid supporter of service learning as a proponent of charity, coined the image of "a thousand points of light" representing the

countless efforts of citizens in responding to America's social problems (Westheimer and Kahne, 1996).

In the political domain, service learning is championed as a mode of developing responsible citizens. Here, the emphasis lies on acts of altruism to produce citizens. Citizenship is promoted as a means of acting in a decent way toward people living within a community. Former President George Bush illustrated this view in his promotion of the National Community Service Act of 1990:

> I am particularly pleased that this act will promote an ethic of community service. …Government cannot rebuild a family or reclaim a sense of neighborhood, and no bureaucratic program will ever solve the pressing human problems that can be addressed by a vast galaxy of people working voluntarily in their own backyards (Westheimer and Kahne, 1996).

In the above quote, former president George Bush advances voluntary community service as an alternative to governmental programs. Instead of addressing the structural injustices, Bush advocates a kind of service that may be understood as a form of noblesse oblige- a private act of kindness performed by the privilege. Under the charity orientation, a duty to the community is lost and so is a sense of citizenship (Westheimer and Kahne, 1996).

In the intellectual domain, the charity orientation stresses the additive role of service learning. Educators under this philosophy promote service learning activities that lead to raised self esteem, impel students into new experiences, and demonstrate the value of academic abilities in real-world context. (Westheimer and Kahne, 1996).

Change Orientation

Service learning activities that encourage 'change' among its participants emphasizes very different moral, political, and intellectual domains. Morally, the 'change' orientation aims to deepen relationships and to forge new connections. Noddings expresses this moral domain of caring as an attempt to "apprehend the reality of the other" and then to "struggle for progress together." Noddings continues to explain that when one cares, a relationship develops in which "the other's reality becomes a real

possibility for [one]" (1984). Unlike the giving approach inherent in the 'charity' orientation, the distance between the one caring and the one cared for diminishes. Those being served are no longer viewed as clients.

Under the 'change' orientation, the political emphasis is focused on creating critical thinking citizens. Here, practitioners argue that important opportunities are foregone if the act of service is separated from a critical examination of the setting in which it occurs. In Bush's earlier quote, the former president advanced voluntary community service over government programs. Bush never alluded to the changes that might address the structural injustices that leave people in need and neighborhoods in decline. Westheimer and Kahne (1996) address a different definition of citizenship by stating that:

> Citizenship in a democratic community requires more than kindness and decency; it requires engagement in complex social and institutional endeavors. Acts of civic duty cannot replace government programs or forms of collective social action. Citizenship requires that individuals work to create, evaluate, criticize, and change public institutions and programs.

In the intellectual domain, the focus is on transformation. Reflection activities can encourage the transformative power of service learning experiences. Yet this role is only achieved when reflections include critical thinking. Critical thinking probes students to consider arguments that justify conclusions that conflict with their own predispositions and self-interest. Through the combination of service and critical analysis, interest in and insight into complex social issues is promoted (Westheimer and Kahne, 1996).

Environmental Education Service Learning

Service learning can be found in a range of environmental studies programs. The University of Redlands, Middlebury College, and Denison University demonstrate service learning environmental courses at both the introductory level and at an upper level. Despite the fact that they may range in format and institutional support, these

models depict the variety of service learning experiences applicable to environmental courses.

The University of Redlands is located in Southern California. For years the University has maintained its commitment to developing student citizenship through service. The university administration also desires to build a green campus and is dedicated to programs and projects that further the campus's sustainability. (Jenks-Jay, 1999)

Students can enroll in an introductory environmental studies course that explores a variety of environmental topics. In the beginning of the course, students are asked to identify environmental issues on campus that concern them. After students have reviewed readings on group dynamics and acquired skills necessary to gather information from public sources, the class selects a campus concern to address as a group. These concerns typically coincide with those of the university. (Jenks-Jay, 1999)

The administration's commitment to a green campus provides an open opportunity for students to study and improve their campus. Relevant individuals are consulted for permission and guidance in exploring various topics. These collaborations have resulted in projects that assisted with such things as composting green waste, redesigning an irrigation system, monitoring an invasive plant along the creek on campus, siting new bicycle facilities, replacing disposable cups with re-useable mugs, upgrading the recycling program, and developing a wilderness connection initiative. (Jenks-Jay, 1999)

At Middlebury College, located in Vermont, service learning is found often in the curriculum of a senior seminar course entitled: Environmental Studies 401 (ES401). This course provides flexible opportunities for students with varied interests. However, regardless of research interests, all projects must focus on local or regional environmental issues. The instructor decides what topic the course will focus on and whether or not it will be service learning oriented. In the past, seminars have analyzed the possibilities for

recycling on Middlebury's campus and helped a community develop environmentally sound plans for a new elementary school. (Elder, 111)

In 1993, Middlebury students worked with local elementary and junior high teachers to develop and implement place-based curricula. Referred to as the Watershed Partnerships, this initiative paired interested students with classroom teachers to discover environmental educational approaches that were distinctive and appropriate to particular communities. Through these collaborations, oral histories, nature trails, local wildlife guides, animal shelters, and agricultural histories have been developed to enhance the curriculum of local schools. (Elder, 117)

Denison University's Environmental Studies Department offers an upper level service learning course that focuses specifically on K-12 environmental education. Enrolled students are asked to consider how they can enhance environmental education in their communities. To explore this question, students are required to spend approximately 20 hours as a teacher of environmental education in a local school. Students must also submit a proposal for the enhancement of local environmental education initiatives. Proposals follow the format of the Ohio Environmental Education Fund grant proposal. The proposal must outline ways in which Denison can contribute to improving environmental education in Ohio (Korfmacher, 1998).

Classroom lectures explore the history of environmental education, introduce students to service learning, review critiques of environmental education, and address ways to evaluate environmental education. In addition to attending lectures and reading assigned works, students are asked to reflect on their readings and teaching experience weekly. Host teachers also evaluate student contributions in the field (Korfmacher, 1998).

The environmental courses offered at the University of Redlands, Middlebury College, and Denison University incorporate many of the service learning program characteristics identified by Eyler and Giles discussed earlier in this chapter. University of Redland's Introductory Environmental Studies course contains at least three out of the six program characteristics. These include placement quality, application, and diversity.

Occasionally community voice and reciprocity are achieved when student projects coincide with university needs. No mention was made about reflection. Middlebury's Environmental Studies course contains five program characteristics. Again, no mention was made of reflection. Referring to this course, Elder comments on the life long connections that frequently form between college-aged students and local children. This demonstrates the diversity and reciprocity characteristics of service learning. Denison University's Environmental Education course illustrates at least four of the six program characteristics. Based on the class syllabus, placement quality, application, reflection, and diversity are all included in the course design. However, it is not clear whether or not community voice and reciprocity are achieved.

Summary

Chapter two begins with a definition of environmental education. A brief historical perspective is offered to suggest how human relationships with nature have evolved to today's current environmental crisis. Environmental education is then offered as a tool to help citizens understand the inherent complexity of environmental issues. From here, the reader is introduced to the pedagogy of service learning and its role in environmental education. Successful service learning courses foster the personal and intellectual growth of student participants. They contain program characteristics such as placement quality, application, reflection, diversity, community voice, and reciprocity. Through service involvement, service learning becomes a philosophy as well as a pedagogy. As a philosophy, service learning results in either a change or charity orientation. The resulting orientation depends largely on the relationship that exists between the service provider and the recipient and the level of inquiry encouraged among its participants. Chapter two concludes with a description of existing environmental education service learning courses.

CHAPTER 3

METHODOLOGY

The present chapter provides the design of my study as it relates to whether or not service learning is an appropriate approach to environmental education. Research methods, conception and preparation for the study, course activities, data sources, and data analysis used in the study are explained**.**

Design

The design for this study incorporated both qualitative and quantitative methodologies. The study employed a qualitative research form known as a case study. The study also used a quantitative research tool known as a one-group pretest-posttest design to identify content learning gained as a result of participation in the course.

Qualitative research covers several forms of inquiry that facilitates the understanding and meaning of social phenomena occurring within its natural setting. All forms of qualitative studies consist of four common characteristics. First, the focus is on the interpretation and meaning derived from those involved. Secondly, the researcher is the primary instrument in data collection and analyses. Thirdly, research activities frequently result in fieldwork. And finally, the process employs a primarily inductive strategy (Merriam, 1992).

In qualitative research, there is an assumption of epistemology. Epistemology refers to ways of knowing. In qualitative research, the researcher's knowledge of the area of study affects these ways of knowing. In my study, I interacted with participants as one who is knowledgeable about environmental service learning education. My knowledge comes from my experiences, readings, and professional conversations. According to Merriam (1988), the goal of qualitative research is to "understand the meaning of an experience" (p.16). Because I was interested in finding

out whether or not service learning is an appropriate approach to environmental education, I conducted this study from a qualitative perspective.

One of the most popular forms of qualitative research is the case study. Defined by Merriam, "a qualitative case study is an intensive, holistic description and analysis of a single instance, phenomenon, or social unit" (1988). Case studies revolve around a bounded system. These finite systems may include such specific and functioning units as a classroom or a program. The freshmen seminar in this research is the case study.

Since content is important in environmental service learning education, I was also interested in finding out if participants increased their knowledge. Therefore, the pre-experimental design of one-group pretest-posttest was used as a quantitative measurement (Campbell & Stanley, 1963). Originally, I had intended to employ the true experimental design of pretest-posttest control group. However, due to circumstances beyond my control, I was unable to utilize a control group.

Using only one group, which may be created either by random selection or by using an existing intact group, this design can be used to establish causation. The approach involves the administration of a pre-treatment evaluation followed by a post-treatment evaluation (Letendre & Lipka, 2000). While one-group pretest-posttest design is frequently used in educational research, it is important to note inherent weaknesses that can jeopardize internal validity. Internal validity addresses the extent to which the treatment made a difference. History, maturation, testing, and experimental mortality are classes of extraneous variables that may confound this study.

Conception and Preparation of Study

A seminar was developed to assess the appropriateness of a service learning approach to environmental education courses. The following outlines the lifeline of the seminar. It begins with the inception of the seminar and highlights the preparatory classes and work involved before the implementation of the seminar. It then describes the "*Living Upstream: Learning How To Serve Our Downstream Neighbors*" seminar.

Sample lecture topics, fieldwork experiences, and evaluation questions are included to illustrate the structure of the seminar.

In the fall of 1999, I decided to create an environmental science service learning course. Based on my positive undergraduate experience with service learning courses, I hoped to provide an opportunity for students in secondary education to experience this pedagogy. I wanted the course to broadly focus on environmental issues ranging from habitat fragmentation to water pollution. Hoping that my alumni high school - Woodward Academy - would host this course, I began to contact my former science teachers, department heads, headmasters, and president. In addition, I wrote and submitted my course proposal to the University of Georgia's Office of Public Service and Outreach. My proposal was accepted by the university but not by Woodward. Woodward cited concerns regarding liability and teaching qualifications.

In the spring of 2000, I participated in two classes that ultimately led to the creation of the undergraduate environmental education service learning course in this study. *Academic Community Learning,* a course offered by the University of Georgia's College of Education to any undergraduate or graduate throughout the university, further exposed me to the service learning pedagogy. *The Altamaha Initiative*, a course offered by the University of Georgia's Institute of Ecology, highlighted the ecological concerns facing the Altamaha watershed and the community needs of those who lived and worked within the watershed.

The *Academic Community Learning* course, taught by Dr. Elizabeth Pate, exposed me to the history, ideology, and philosophy of service learning. Enrolled students were asked to work in teams or individually to create and implement their own service learning project for the semester. Projects were to be based on a need identified by the community.

The *Altamaha Initiative* course, taught by Dr. Laurie Fowler, raised my awareness of the Altamaha watershed. The Altamaha watershed, a term used to refer to the land area for which a river or stream drains, is often referred to as "Georgia's Mightiest

River". Consisting of the Oconee, Ocmulgee, and Ohoppee Rivers, the Altamaha watershed drains ¼ of Georgia's land mass. This massive river system flows through the South's last remaining hardwood bottomlands, cypress swamps, historic rice fields, and marshes. The watershed also supports at least 125 species of rare or endangered plants and animals including the shortnose sturgeon, swallow-tailed kite, and gopher tortoise.

I was one of three graduate students enrolled in Dr. Fowler's course. Our assignment was to identify stakeholders living within the watershed, assess the role of each stakeholder in the watershed, and create a list of expressed community needs. This information was gathered through a series of interviews. The aim of this initial research project was to provide the foundation for future graduate level Altamaha service learning courses.

An interview with the Altamaha Riverkeeper and The Upper Oconee Watershed Network highlighted the need for water based education initiatives at all academic levels. The Altamaha Riverkeeper is a non-profit organization whose mission is to restore and preserve the habitat, water and flow of the mighty Altamaha River. (Altamaha Riverkeeper, 2001). James Holland of the Altamaha Riverkeeper notified me that he needed upstream citizens to sample and monitor their waters. He also emphasized the need to educate citizens about their watersheds. The Upper Oconee Watershed Network (UOWN) reiterated this need in the spring of 2000. UOWN, a non-profit dedicated to improving water quality through community-based advocacy, monitoring and education, operates in the upper reaches of the Altamaha watershed. Based on these cumulative requests, I decided to develop an environmental education seminar with a focus on water issues facing the Altamaha watershed. The seminar would utilize a service learning approach and would be offered to University of Georgia freshmen.

In conjunction with Dr. Pate's course, I developed a portfolio for my environmental education service learning project. The portfolio included an abstract, a rationale/needs statement, a definition of service learning, the goals of the project, the context, a list of collaborators, and the academic connections I had incurred over the

course of the semester. In addition, I wrote and submitted a proposal to the Georgia Sea Grant. The Georgia Sea Grant program, part of the National Sea Grant program, aims to work with government, industry, and resource users to assure an environmentally healthy coast for the future while creating sustainable jobs in the present (Georgia Sea Grant College Program, 2001).

The proposal outlined the need for freshman seminar courses focusing on water quality and quantity issues within the Altamaha Watershed. The seminars would be offered under UGA's Freshman Seminar Program. Sponsored by the Franklin College of Arts and Sciences and the Honors Program, the Freshman Seminar Program was designed to acquaint incoming students to potential majors. Dr. Pate and I would jointly teach the seminars. We proposed to offer both a fall and a spring seminar. After the fall seminar, Dr. Pate and I would assess its strengths and weaknesses. Conclusions from this assessment would serve to direct the structural changes for the spring seminar.

In these one-credit hour seminars, students would learn to collect and test water samples for phosphorus, nitrogen, temperature, conductivity, dissolved oxygen, turbidity, and pH levels. The freshman seminars were called *Living Upstream: Learning How To Serve Our Downstream Neighbors*. In May 2000, Sea Grant accepted my proposal.

During the summer of 2000, I focused solely on developing the content curriculum for the fall semester. I intended to offer two seminar courses for the 2000-2001 academic year. The fall seminar would provide suggestions and direction for the spring seminar. I began by outlining the general topics and subjects I wanted my students to learn. All topics related directly to watershed concepts, water quality/ quantity issues, and service learning.

To gain an intimate knowledge of the Altamaha watershed, I spent a week interning at the Altamaha Riverkeeper office in Darien Georgia. This coastal Georgia town is rich in estuary wildlife. During my stay, I assisted James Holland in the field as he collected water samples from potential pollution sources. I also spoke to local fishermen and landowners to assess their perspective regarding their local waters.

Once I had familiarized myself with the lower reaches of the Altamaha watershed, I returned to Athens to explore two of the watershed's tributaries: the Middle Oconee and the North Oconee Rivers. The headwaters of both the North and Middle Oconee Rivers begin in Hall County. Flowing through Georgia's piedmont region, the rivers are generally well entrenched and flow through narrow floodplains. The two rivers run for 55 to 65 miles prior to joining below Athens to form the Oconee River (Georgia Department of Natural Resources, 1998).

By the time it reaches Athens-Clarke County, the Middle Oconee is roughly 30-40 feet wide. The Middle Oconee follows a relatively flat gradient as it flows through the commercial sections of Athens. The river's geomorphology could be described as a series of sandy shoals.

The North Oconee River flows through agricultural, urban, and forested lands prior to reaching Athens. In Athens, the river is roughly 50 feet wide. The North Oconee follows a steeper gradient as it traverses downtown Athens. This steady drop in elevation makes the river more conducive to canoeing. I chose this river as the focus of my freshman seminar.

Course Activities and Data Sources

Seven freshmen enrolled in the fall seminar. At the beginning of the seminar, an open syllabus was distributed to each student. The syllabus outlined the course agenda for the first half of the semester while the second half remained blank. It was explained to the students that they would play a substantial role in determining our course path during the second half of the semester. At that time, we would all contribute to our educational direction and would complete the open sections of the syllabus (Refer to Fall Semester Syllabus in Appendix A).

The syllabus also outlined general classroom policies and expectations. Students were asked to submit weekly reflection essays. Reflections provided a private venue for students to convey their feelings and intuitive thoughts on specific issues and experiences

(Silcox, 1993). In addition, reflections helped to document a student's intellectual and personal growth as they struggled to understand themselves in the world.

Reflection essays were to be roughly one page in length. Students were given the option to reflect on specific questions distributed after each classroom lecture or they could reflect on any other related topic. No one chose this second option.

In addition to weekly reflection essays, students were expected to create and implement a community project that directly applied their classroom learnings. The service project would be determined by consensus around mid-semester.

The class syllabus was included in a three ring binder given to each student on the first day of class. This binder also included a number of maps illustrating the geographic boundaries of the Altamaha watershed and contributing aquifers, and diagrams illustrating concepts that would be covered in the weeks ahead.

Following the seminar introduction, students were asked to complete a pre-semester content test. This 15 question test covered topics ranging from urban impacts on water quality to scientific terminology (Appendix B). A sample question follows.

> The Altamaha River system drains one fourth of Georgia.
> This includes:
> a. Athens, Macon, and parts of Albany
> b. Macon, Albany, and parts of Augusta
> c. Macon, Albany, and parts of Athens
> d. Athens, Macon, and parts of Atlanta.
>
> 1. This is an informed answer
> 2. This is a guess

Following each question, students were asked to indicate whether or not they truly knew the answer or had simply guessed. This feature allowed for four possible student responses: 1. A correctly informed answer, 2. A correctly guessed answer, 3. An incorrectly informed answer, and 4. An incorrectly guessed answer. The pre-semester content test served to assess the students' current knowledge regarding water quality/quantity issues and provide a basis from which to assess knowledge accumulated throughout the semester.

Students were also asked to complete an interest and concern inventory (Refer to Fall Pre-semester Inventory in Appendix C). The interest and concern inventory helped to assess student opinions on water related issues and understanding of the service learning process. The fall pre-semester inventory consisted of seven short-answer questions such as:

> Have you ever participated in service learning activities before this semester?
> What is your definition of service learning?
> What concerns you most about water quality? Why?

The inventory also asked students to rank themselves on various character traits. The ranking scale was from 1 to 4, 4 being "excellent" and 1 being "poor". Seventeen character traits were listed. These included team-building, team work, leadership, reflective thinking, community concerns, civic responsibility, self-awareness, environmental concerns, resourcefulness, problem solving, observation, motivation, control of one's fate, self confidence, altruism, autonomy, and ability to make a difference. Each character trait was defined on the inventory to clarify the concept for the student and to offer a uniform definition from which to work.

Finally, students were asked to sign a consent form. It was explained to the students that these forms would give Elizabeth and me permission to share their work with others. Signing was voluntary.

Classroom Lectures and Field Work

The first eight weeks covered specific topics relating to water quality and quantity. For instance, during the third week of class, students were presented a lecture entitled "Introduction to the 21st century oil $\rightarrow$ WATER". The lecture began with a historical perspective depicting the role water played for the Anazsi Indians and for the founding fathers of the University of Georgia. From here, we explored the elements of the hydrologic cycle and reinforced the concept that the earth's water is recycled over and over again. The students also received a terminology sheet covering the words discussed that day in class. The reflection question for that class asked students whether or not they

realized that our available water resources are recycled over and over again. I then asked them whether or not this recycling concept would cause them to reconsider the way in which they used water. (Appendix D)

During the fifth week of class, we canoed the North Oconee River. A reporter from a local newspaper joined us on our trip. For the next 5 hours, this urban river served as our classroom. Before setting out for our canoe trip, we viewed aerial photography depicting the segment of river that we would explore that day. At this time, students witnessed the sinuosity of the North Oconee and gained a "big picture" of a river surrounded by urban development. Students also learned how to use a variety of tests to sample dissolved oxygen, phosphorus, nitrogen, temperature, conductivity, pH, and turbidity. After this review, we set out to canoe the North Oconee.

We began by paddling upstream towards the Athens-Clarke County drinking water treatment plant. Here, I explained the role of a drinking water treatment plant and how it related to the human process of recycling water. I explained that further downstream a wastewater treatment plant would receive our used waste water, treat it, and then return it to the North Oconee River. From here, the water would flow downstream eventually reaching Darien, Georgia. I often referred to Darien Georgia to illustrate a downstream community because one of my students was from Darien and lived adjacent to the river's estuaries. Before leaving this site, the students and I used our water quality test kits to sample and analyze the waters just below the water treatment plant.

Downstream from the water treatment plant, we encountered a trash embedded section of the river bank. As we continued downstream, I explained that this riparian zone was once used as a landfill. Although the landfill had been closed, it left a legacy of rubber tires, bed pans, concrete slabs, and other debris as the structural component of the river's bank. This site had a huge impact on our students. We spent roughly 45 minutes

talking about the site, awing the trash in the bank, and sampling the waters next to the historical legacy.

Adjacent to the landfill is a decommissioned smoke stack housing the remains of an incinerator. Prior to 1972 much of Athens' waste was incinerated into ash releasing heavy clouds of black smoke into the air each day. The ash was then dumped into idle pick-up trucks and then removed from the incinerator site. Many of the melted glass jars and containers found in the closed landfill upstream were reminiscent of the incinerator activities occurring in the early 1900s. At this site, we took our third water sample and analyzed its quality.

Further downstream, our class approached the North Avenue Bridge. Students were familiar with this road and its location in downtown Athens. Here we discovered a homeless population living under the bridge's shelter. After we had cleared the bridge we brainstormed about how the homeless people's health might be jeopardized by using untreated river water for their bathing and washing needs. We also discussed whether or not this homeless camp was impacting the river's water.

After the homeless camp, we encountered a transmission line covered in kudzu. On closer examination, the students noticed that colored flagging was marking the site. I explained that this site had been used as a dumping ground for the incinerator ash mentioned earlier. In addition, Georgia Power had used the site to operate one of its coal gasification plants in the early 1900s. These two land uses contaminated the surrounding soil with metallic ash and coal tar. I explained that the site was scheduled for remediation in April 2001.

Our trip ended at a city park referred to as Dudley Park. Dudley Park is border on one side by the North Oconee and on the other side by Trail Creek. The students took their 4th water sample at the confluence of the river and creek.

Following our trip, the students were asked to reflect on the following questions:

> What did you learn on our float trip that really made an impression on you? Do you think more Athens' residents

> should discover/learn the types of things we have seen today? Do you think many Athens' residents know the state of their rivers? Overall, how do you feel about our water resources (overwhelmed, frightened, empowered, amazed, etc.)? If you had not participated in a seminar/float trip during your undergraduate career do you think you would have learned about Athens' water supply and the threats facing it?
> Athens receives some of its drinking water above the landfill site we saw today. If you lived in Milledgeville (a town south of Athens that relies on the lower reaches of the North Oconee for its drinking water needs) would you worry about the land activities occurring in the Athens area? Would you be concerned about Athens' water quality if you lived in Darien?

These questions sought to assess the educational impact of our trip and enforce a holistic perspective of the Altamaha watershed.

Following our float trip, our water samples were given to the analytical chemist in the Institute of Ecology. The lab coordinator offered to analyze the phosphorus and nitrogen levels in our samples. Although the students had performed rudimentary phosphorus and nitrogen analysis in the field, I wanted them to compare their field data with lab data. This would allow them to decipher the differences in accuracy between field data and lab data.

Service Learning Project Conception and Development

On the eighth week of the semester, Dr. Elizabeth Pate led the class in a brainstorming activity. The purpose of this activity was to generate project ideas that would serve as our service learning project. The only stipulation we had was that our idea must continue to fulfill the voiced need for increased water resource awareness.

Students suggested everything from holding a car wash where biodegradable and eco-friendly soaps were used to developing a consumer guide on environmentally safe cleaning products. Ultimately, the class decided to create a video that would highlight the land use activities they saw along the North Oconee River. The educational video would be developed for local schools, community organizations, religious groups, and anyone else interested in learning about the area's water quality.

Following the consensus exercise and the determination of our service project, each student was handed a project development work sheet. The worksheet was used as a tool to help the class conceptually structure the service project and identify the areas in which learning should occur over the duration of the project. The worksheet consisted of nine subject headings including: Community Need, Learning, Student Participants, Partner(s), Project Explanation, Action-Service Given, Reflection, Evaluation, Publicity. Each category was followed by a series of questions (Appendix E). For instances, under the Project Explanation category, students were asked the following:

1. What will we do?
2. What kind of preparation will we need before doing this project?
3. What will others involved with the project do?
4. What is our projected timeline for the project?

On the ninth week, students were handed a revised copy of the project worksheet. This copy included student responses to each question and provided additional room for the student to take notes. We also conceptually organized the topics of our video. The chronological order for the video would largely follow the north-south orientation of the land uses we encountered on our float trip. The video would also be organized into two sections: one highlighting the river's water quality problems and one exploring solutions to water quality problems. After we had identified all the topics for the video, students were asked to choose a topic they wanted to research further. They were provided with individual contact names and numbers and other helpful suggestions to begin their research.

Students were asked to maintain a log of activities documenting their research and learning activities. It was explained to the students that this list would serve as their learning inventory. Suggested learning activities might include internet research, conversations with community members, attendance at community meetings, and so forth.

Students were also asked to reflect on the following questions for the remainder of the semester:

What have you learned in regards to:
- Watersheds?
- Your community?
- Yourself?

Have you gained any additional skills?

Students were instructed to revisit these ongoing reflection questions after each class. Lists of suplementary questions were provided to help students focus and direct their ongoing reflections. Once again, students decided whether or not to use these questions (Appendix F).

The tenth week of class served as a work session structured specifically to allow for individual research time. Students were told that they could use this time to research their topics on the computer, share research experiences with peers, or ask Elizabeth and me any questions they might have. Many students chose to share their research experiences with one another and asked for feedback and direction. One student expressed frustration about contacting an informant. Another student asked how they should justify their questions to a curious informant.

Before dismissing the students to continue their individual research efforts, I shared the analytical lab results for phosphorus and nitrogen with them. I explained why our field values differed from the laboratory values and tried to demonstrate the importance of each data collection effort.

The eleventh week of class began with each student sharing his/her research progress. After this exercise, an invited speaker from UGA's Office of Instructional Support and Development spoke to our class about video production. She introduced us to the process of developing a "storyboard". A storyboard is a tool used by multimedia designers to map out and organize their project ideas prior to producing the project. The storyboard is essentially a project overview that should include drawings of screen shots, a list of video and sound needs, and suggested background music (Chung, 2000).

Following this introduction, students were asked to begin creating a storyboard for their individual research topics.

The speaker also outlined the video production options available to our class for the remainder of the semester. She realistically described the work that was involved in producing a video and stressed that the remaining 5 weeks of the semester would not be sufficient to create a quality product. She continued by stating that if our desire was simply to educate our community on water issues, perhaps we didn't necessarily need a high quality video to fulfill this goal. At the end of class, a student asked if the seminar could be extended into the spring semester to allow for the creation of a high quality video. Elizabeth and I decided to present this option to the class the following week. If they agreed to continue the seminar, then we would cancel our offer to teach the seminar for a second time in the spring. We would instead devote our time to these students and their project.

On the twelfth week of class, Elizabeth and I presented a proposal for extending our seminar into the spring. The spring seminar would further explore water quality/quantity issues and allow for additional time to work on our community video project. We decided that we would meet on an irregular basis but for a longer time. Classes with 2 to 3 hour time frames would provide greater flexibility than meeting for one hour every week. This flexibility would also allow students to schedule classes needed to fulfill graduation requirements. We received a favorable response from 6 out of our 7 students. When asked why they wanted to continue the seminar, one student stated:

> "I would like to produce a quality product that will not look hastily put together with poor research and workmanship. To do this I feel I/we will need an extra semester to accomplish and produce a quality video."

The thirteenth week of class was devoted primarily to individual progress reports. At this time, students shared their storyboards and research efforts with the class. We also determined the class agenda for the remainder of the semester.

On the fourteenth week, we met in a technology-equipped room to draft the introduction of our video. The students decided that they wanted the video to focus on the problems and solutions facing all urban rivers. The North Oconee would serve to illustrate these.

Kevin Hoth joined us for class on the fifteenth week of the semester. Mr. Hoth has experience producing videos. He offered to collaborate with our class in developing our video project. Mr. Hoth showed us examples of his work and explained the capabilities of his recording equipment. He also answered individual student questions. Following his presentation, our class decided to canoe the North Oconee in early January. At this time, Mr. Hoth would record the land uses we researched along the North Oconee.

Our fall seminar ended in early December. The last class of the semester was spent celebrating our accomplishments. At this time, students were asked to temporarily turn in their individual storyboards, research results, log of activities, and classroom binders. These materials would be returned to the students after the individual storyboards had been compiled over the winter break.

Students were also asked to complete a post-semester content test, a fall post-semester inventory, and a freshman seminar review evaluation. The post semester content test consisted of the same 15-multiple choice questions as the pre-semester content test. The inventory consisted of 10 short-answer questions. The fall post-semester inventory contained similar questions as those found on the fall pre-semester inventory. However, new and original questions did appear on the fall post-semester inventory. These questions reflected the evolution of course-based learnings. Sample questions follow.

> Is there a difference between service learning and community volunteering? Why or why not?
> Who will be the recipient of our service learning project?
> What course related concepts, issues, or themes do you understand better as a result of our service learning project?

Following the short-answer questions, students were asked to rank themselves on the seventeen character traits (Refer to Fall Post-semester Inventory in Appendix C).

The freshman seminar review evaluation was created and administered by the Franklin College of Arts and Sciences. The purpose of the evaluation was to evaluate the success of the program and to identify ways in which the program could be improved or further developed. Students were asked questions such as:

> In general, did you enjoy your freshman seminar? Why?
> Did this class fulfill your expectations? Why?

Spring Seminar

The spring semester began with another float trip down the North Oconee River. Invitations for this trip were extended to members of the Upper Oconee Watershed Network and to a National Public Radio reporter. The purpose of the trip was to record footage of the land uses our students saw on their fall float trip. With stops along the way, it took roughly 4 hours to completely paddle the two-mile stretch.

Our second class meeting was held in early February. At this time, student storyboards, research results, and notebooks were returned. The spring class was not outlined in a syllabus due to the scheduling flexibility necessitated by our video project. Instead, we decided to determine the class structure based on the educational and project goals dictated week by week by our community project. The spring syllabus found in Figure A2, Appendix A serves to outline the course for the reader.

Students were asked to provide feedback on the video's storyboard at our second meeting. This overarching storyboard included the student's individual storyboards. Following the critique, Mr. Hoth showed us the video clippings he recorded on our canoe trip. Students suggested layout options and other ideas regarding the production of the video. The class meeting lasted roughly 3 hours. We decided to meet again in two weeks.

A guest speaker joined us for our next meeting. Speaker topics were determined by either student recommendation or by the instructors' desire to cover topics that had not yet been addressed. Our first speaker spoke to us about the impacts of dams. The speaker highlighted the physical, chemical and biological impacts that dams create on river

systems. The lecture specifically focused on dams within the Altamaha watershed. The students were instructed to write a reflection based on the speaker's lecture and our ongoing video project. Questions were provided to guide them in their reflection activity. Some of these questions included:

> Do you feel like you are an integral part of our class project? Why or Why not?
> Suppose that GA Power proposes to build a reservoir just upstream from the drinking water treatment plant on the North Oconee River. How could you argue both for and against this proposal?
> (Things to think about: How would this proposal impact Athens' drinking water? How would the proposal impact those who live in the designated reservoir site? How might the proposal impact the river's aquatic life? How might the proposal impact those living downstream (both humans and non-humans)?
> Be sure to address all of the benefits and drawbacks of this proposal that you can think of).

After our guest lecture, we discussed who would be the narrator of the video. We decided to hold informal auditions for everyone in the class. The auditions would be held during our next meeting time. Following this discussion, Mr. Hoth showed us a new edition of our video. In this edition, the video footage was arranged in the order in which it was encountered on our canoe trip. Mr. Hoth also added music and place-holders to this edition. This meeting lasted roughly 3 hours. After the meeting, we decided to meet again after spring break.

Another guest speaker joined us for our fourth meeting. Her lecture focused on the Clean Water Act and the provision that mandates total maximum daily loads (TMDLs) for waters that fail to meet their designated uses. This lecture exposed the students to environmental law and its ability to protect our water resources. Following her lecture, the students auditioned for the role of the narrator by reading parts of the script into a tape recorder. This meeting lasted an hour and a half.

The fifth meeting was devoted to creating the brochure that would accompany the video. At this time, students brainstormed ideas and identified the major concepts they hoped to summarize in the brochure.

In late April, we traveled to Darien, Georgia for our celebratory float trip on the Altamaha River. The purpose of this trip was three-fold. First of all, the trip would allow the students to experience the magnitude of the Altamaha River watershed and foster a holistic understanding of the interconnected nature between the North Oconee River and the Altamaha River. Secondly, it would demonstrate the biological richness supported by the river. And finally, the trip would mark the successful completion of the seminar and our community video project.

The seminar officially concluded in early May. At this time, students were asked to complete the post-semester content test, the spring post-semester inventory, and the University's course evaluation form. The questions on the post-semester content test were the same as those seen by the students in the beginning and end of the Fall 2000 seminar. The spring post-semester inventory consisted of 7 short answer questions such as:

> What do you feel is your main contribution to our video project?
> What has been the most difficult part of our class for you?
> What insights have you gained into people and their role in protecting our water resources?

The inventory also asked students to rank themselves on the seventeen character traits (Refer to Spring Post-semester Inventory in Appendix C).

The spring seminar began with an enrollment of 6 students but ended with 3 students. Withdrawn students cited course load concerns and other time conflicts.

Data Analysis

The three primary sources of data used in this study were reflections, pre and post content test results, and interest and concern inventories. In order to address the question of whether or not service learning is an appropriate approach to environmental education, I looked across these three data sources.

The first step in data analysis was a review of reflections. For each student I reread each reflection looking specifically for instances in which they discussed their thoughts regarding service learning, content learning, connections between classroom experiences and those outside academia, change in themselves, community connections, environmental stewardship, and acquired skills. I chose these themes because of their prominent role in the service learning literature and the student growth that each theme helps to identify.

The second step in data analysis examined results of the pre and post content tests. Special attention was focused on students' correctly informed responses. Content retention was measured based on the percentage growth that occurred between fall pre and post semester content tests. For spring students, content growth was determined based on percentage change between fall pre-semester content scores and spring post-semester content scores.

The third step in data analysis involved the interest and concern inventories. Special attention was given to student responses for questions that appeared in both the pre and post inventories. For instance, in both of the fall inventories, students were asked to define "good water quality". Their responses were assessed to see if and how student definitions of water quality evolved over the course of the semester. Student responses were also surveyed to determine whether or not a distinction between service learning and community volunteering had been made. The role of our service learning project in clarifying course concepts and themes was also assessed. Responses from students who completed the spring seminar and the spring post-semester inventory were further evaluated for content application and reference to citizen responsibility.

Summary

Chapter three begins by outlining the research design employed to address the question of whether or not service learning is an appropriate approach to environmental education. For this research, a case study and a one-group pretest-posttest design provided the qualitative and quantitative methodologies respectively. From here, the life-

line of the study is presented. A description of the conception and development of the freshmen seminars, course topics and activities, and data sources follow. Finally, the methods for data analysis are presented.

CHAPTER 4

RESULTS

The present chapter highlights the results of this study. General demographics of the fall and spring seminar participants are offered followed by detailed descriptions of each individual student. Detailed descriptions serve to ground student quotes and provide the reader with a framework from which to better understand each student. Descriptions are based on information provided in the interest and concern inventories, as well as, through interaction with instructors. In order to protect the privacy of each student, pseudonyms are used.

Qualitative results from student reflections and interest and concern inventories are presented for each student. Student reflections and interest and concern inventories help to illustrate the personal and cognitive growth experienced by each student. For students enrolled in the fall seminar, a total of 14 reflections were submitted. Students enrolled in the spring seminar wrote an additional 2 reflections. Quotes were extracted from student reflections and included below. Students often did not edit reflections. Therefore, editorial changes in reflections are included in brackets for ease of reading. Quantitative results from pre and post semester content tests are also provided for each student. Summary statements regarding growth and development are also included for each student.

Student Demographics

"Living Upstream: Learning How To Serve Our Downstream Neighbors" had a fall enrollment of seven students. Six out of the seven students were females. Five out of the seven students were Caucasian, one was African American, and one was of mixed descent. Six students were between the ages of 18-19 while only one was non-traditional. All students were born and raised in Georgia.

Intended student majors included pre-med, drama, middle school education, computer programming, and veterinarian science/marine science. Two students were undecided. None of the students had ever participated in service learning activities prior to this seminar. Three students reported participating in environmental advocacy work.

Melanie

Melanie is a student from Cordele, Georgia. Here she lives along the Flint River where she enjoys swimming and tubing. With aspirations to major in pre-med, Melanie is a diligent worker who completed assignments on time and was typically the first one to arrive for class. She enrolled in the seminar because she "likes sciences and dealing with outdoors stuff".

Reflections

In one of her first journal entries, Melanie states her preference for an applied form of learning. She explains:

> "I believe that no matter how much book smarts you have it is really not an asset to you unless you are able to incorporate it into everyday life. It sounds [like] service learning will help me better my skills at this…If I can find use for the subject matter or see examples in real life, it encourages me to try to learn more."

To Melanie, knowledge is demonstrated through direct application. When this occurs, learning is enjoyable and fruitful.

Early in the semester, Melanie reflects on an article that explained the "Tri-State Water War". The so-called "water war" revolves around water consumption and distribution issues confronting three neighboring states: Georgia, Alabama, and Florida. Reflecting on the article Melanie writes:

> "One of the problems that was mentioned in the article was that water was being used a great deal more because of [growth demands]. I know growth is good, but at some point it seems that they might need to slow growth down before we run out of water and downstream towns suffer."

Here Melanie questions whether or not growth truly is good. She further questions the repercussions of growth and the harm it may incur.

Following our fall canoe trip, Melanie expresses her concern regarding the dumpsite along the North Oconee River. She suggests that our class write and submit a series of awareness articles to the local newspaper. In a journal entry, Melanie outlines the research our class must complete to write awareness articles. She states:

> "We would need to learn [the] history of the trash dump. We could also research how to make the site safe for the water to be near. We could find exactly what dangers come from dumps near water, what toxins are harmful, and what they do to animals and humans who have contact with them. We could get someone that specializes in keeping dump toxins out of water to speak to us about what to look for to determine when a dumpsite, old or new, is harming the water. We would have to collaborate with newspapers to get the word out and maybe other organizations."

Here, Melanie describes the interdisciplinary research and contributions needed to accurately address the decrepit dumpsite.

Melanie reflects on her role as a citizen by stating:

> "I [realize] that even though I'm only living in Athens while I go to school that I still have a responsibility to help keep Athens community clean. Who knows [?] I might end up living in a town where we use water that has traveled through Athens."

She continues by saying:

> "I feel that people are obligated to try to make their community a better place. Whether they do something as small as pick up trash or start a fundraiser or shelter for the homeless it all impacts our (their) community."

These two quotes highlight Melanie's sense of community. She recognizes her obligation to participate as an active citizen and acknowledges the importance of her role regardless of the impact she may have.

Melanie offers a reason for why people lack a commitment to the health of their water resources. She states:

> "I believe it is a big challenge for Americans to think of watersheds as an interconnected system because they see the water in their community and don't think that down the river other communities have to use [the] same water. They see it in their political boundaries and think that it is theirs and that they are the only ones who need to use it. I know that I thought along these lines before I became aware of all the effects an upstream community can have on the water of the downstream community in this class. I think making people more aware about how water systems work can help solve the problem."

This quote illustrates Melanie's awareness that activities occurring upstream impact the health of downstream communities.

Throughout the semester, Melanie also reflected on the different skills she had acquired. In one reflection, she comments that she has "learned to work with others better". She also states that she "learned how to canoe" and has become better acquainted with the Athens area.

Pre-post Content Test

Out of seven students, Melanie received the highest score on the fall pre-semester content test. While most students provided zero to one correctly informed response on the fall pre-semester test, Melanie provided six correctly informed answers. Melanie correctly guessed on three questions and incorrectly guessed on six questions.

Melanie's fall post-semester content test yielded thirteen correctly informed responses. She correctly guessed on one question and incorrectly guessed on one question. For both pre and post-semester content tests, Melanie did not indicate any wrongly informed answers. (Table 1.1)

Table 1.1 Melanie's Content Test Results

	Right-Informed	Right- Guess	Wrong-Informed	Wrong- Guess
Fall pre-test	6	3	0	6
Fall post-test	13	1	0	1

From the above table, 40% of Melanie's fall pre-semester content test responses were correctly informed. 87% of her fall post-semester content test responses were correctly informed. Over the course of the fall semester, Melanie's scores reflect a 46% increase in correctly informed responses.

Inventories

On the fall pre-semester inventory, Melanie defined service learning as "learning things that will help others and myself." When asked to define "good water quality", Melanie stated that it means "no pollution in the water". She stated that her greatest water quality concerns involved "chemicals dropped in the water because they might cause birth defects and other illnesses". She further stated that water quality impacts were a result of "what runs off or what is pumped into the water".

On the fall post-semester inventory, Melanie stated that there was a difference between service learning and community volunteering. She highlighted the academic focus of service learning as the main difference between the two.

Melanie indicated that the service component of the seminar clarified eight out of eleven listed course-related concepts/issues for her. Specifically, clarification occurred with the watershed concept, indications of water quality contaminates, impacts of land use on water quality, opportunities at the community level for citizen involvement in water quality issues, service learning approach to education, role of vegetation in protecting water quality, non-point vs. point source pollution, and available water sources for Georgians. In addition to enhancing her classroom education, Melanie declared that the service project helped her learn about the community.

On her fall post-semester inventory, Melanie defined "good water quality" as "water that has good turbidity and chemical balance with lots of organisms in it". Her greatest water quality concerns involved the contamination of water supplies with cancer causing chemicals. She explained that water quality was impacted by "erosion, chemicals flowing in, [and] wastes".

As mentioned in chapter three, inventories also asked students to rank themselves on seventeen character traits. The ranking scale was from 1 to 4, 4 being "excellent" and 1 being " poor". Melanie indicated an increase in rank for eight of the seventeen character concepts between her fall pre and post-semester inventories. These included leadership, civic responsibility, environmental concerns, observation, motivation, control of one's fate, self-confidence, and autonomy. Three character traits declined in ranking from pre to post semester inventories. Melanie's rankings remained the same for six of the character traits. (Table 1.2)

Table 1.2 Melanie's Character Rankings

	Fall pre-semester	Fall post semester
Team-building	3	2
Team work	3	2
Leadership	2	3
Reflective Thinking	4	4
Community Concerns	3	3
Civic Responsibility	2	3
Self awareness	3	3
Environmental Concerns	3	4
Resourcefulness	4	4
Problem solving	4	4
Observation	3	4
Motivation	3	4
Control of One's Fate	3	4
Self-Confidence	2	3
Altruism	4	3
Autonomy	3	4
Ability to Make a Difference	3	3

Summary

Melanie's reflections clearly convey a preference for applied forms of learning such as service learning. She demonstrates content learning and its application to issues outside of academia. Her reflection on proposed project research and on the public's conception of the watershed concept illustrates this synthesis. Melanie's reflections also

suggest her dedication to the community. She comments on her own stewardship role and how it has changed with her growing realization of watersheds and their interconnected nature. Melanie also identified team-work, canoeing, and an orientation to the Athens community as some of her additionally acquired skills.

Pre and post semester content tests displayed Melanie's understanding of course-based concepts and topics.

Interest and concern inventories also demonstrated Melanie's content growth. Melanie's initial definition of "good water quality" was broad. However, on her fall post-semester inventory, Melanie employed water quality terminology gained in the seminar to define "good water quality". She also applied appropriate water quality terminology in her description of water quality impacts on her fall post-semester inventory. Melanie clearly identified the distinction between service learning and community volunteering. She also recognized the contribution of our service project in clarifying course-related concepts.

Beth

Beth is from Lilburn, Georgia. In the past, she was a volunteer at the Vines Botanical Gardens. Beth was undecided in her major but she chose to register for this freshmen seminar because she "know[s] very little about water quality and want[s] to learn more". Beth appeared enthusiastic and engaged in this seminar. She asked questions freely and displayed a quiet form of leadership.

Reflections

Beth's reflections reveal a preference for hands-on learning. In one reflection, Beth comments:

> "Hands on techniques help me to learn in a more extensive manner…The service learning experience will help me to involve myself in my community in a way that is helpful to others, the environment, and myself."

Beth continually demonstrates an ability to connect classroom teachings with everyday experiences. Her reflections testify that knowledge gained in the classroom shapes her actions outside of the classroom. Beth writes:

> "Knowing that all of the water on this planet is continually recycled absolutely makes me want to use water differently. The thought that how we use water today will have a lasting affect on water quality in the next century should cause people to reevaluate how they use water…It makes me reconsider the amount of water that I use for different purposes."

Beth further reflects and applies classroom knowledge when she interacts with friends and family. In one reflection, Beth replays a discussion she had with a friend who recently visited Israel. She reports:

> "Israel is actually taking water out of the Dead Sea now and desalinizing it for drinking water because…over there, water supplies are scarce. This sea has decreased by about 100 ft during the past 15 years. This really caused me to realize how wastefully I use water."

Beth also displays a commitment to serving community identified needs. When considering potential class projects, Beth states:

> "The determining factor of how productive our project is relies on the community's response to it. Obviously we will have already made somewhat of a difference by learning about water quality and ways we can help, but by involving the community the results will be greater."

In this quote, Beth clearly identifies her commitment to the Athens community. In fact, she claims that the success of our service project will largely depend on the community's response and involvement in it.

Pre-post Content Test

Beth indicated only one correctly informed answer on her fall pre-semester content test. She correctly guessed on four questions and incorrectly guessed on ten questions. Beth provided zero wrongly informed answers on her fall pre-semester content test.

Beth's fall post-semester content test yielded eleven correctly informed responses. She correctly guessed on one question and incorrectly guessed on two questions. Beth gave only one wrongly informed answer. (Table 2.1)

Table 2.1 Beth's Content Test Results

	Right-Informed	Right- Guess	Wrong-Informed	Wrong- Guess
Fall pre-test	1	4	0	10
Fall post-test	11	1	1	2

From the above table, 7% of Beth's fall pre-semester content test responses were correctly informed. 73% of her fall post-semester content test responses were correctly informed. Over the course of the fall semester, Beth's scores reflect a 66% increase in correctly informed responses.

Inventories

On the fall pre-semester inventory, Beth defined service learning as "learning by actually going out and getting involved in the community". When asked to define "good water quality", Beth stated " I am not quite sure". She shared that her greatest water quality concerns were that "we have so much pollution and smog and unneeded chemicals that can contaminate our water supply. This condition could worsen and limit our available drinking water and food supply". Beth stated that water quality impacts are a result of "[Water's] sanitation process [and] how we live by affecting our environment".

On the fall post-semester inventory, Beth stated that there was a difference between service learning and community volunteering. She explained "service learning is when people learn while they serve their community, instead of volunteering for a one time service of some sort in which no learning is present".

Beth indicated that the service component of the seminar clarified eleven out of eleven listed course-related concepts/issues for her. She stated that the service learning project "really makes the material interesting and applicable". In addition to enhancing

her classroom education, Beth declared that the service project helped her learn about the community.

On her fall post-semester inventory, Beth defined "good water quality" as "non-contaminated, unpolluted, fresh, pure, clear, water". She declared her greatest water quality concerns as the fact "that we are slowly destroying the possibility for our water to stay pure". She explained that water quality was impacted by "everything, people, environments, pollution, trash, wastes…".

Between her fall pre and post-semester inventories, Beth indicated an increase in rank for six of the seventeen character concepts. These included team building, civic responsibility, environmental concerns, problem solving, motivation and ability to make a difference. Only one character trait, altruism, declined in ranking from pre to post semester inventories. Beth's rankings remained the same for nine of the character traits. Beth did not indicate a fall pre-semester ranking for "Control of One's Fate".(Table 2.2)

Table 2.2 Beth's Character Rankings

	Fall pre-semester	Fall post semester
Team-building	3	4
Team work	3	3
Leadership	2	2
Reflective Thinking	4	4
Community Concerns	3	3
Civic Responsibility	2	3
Self awareness	3	3
Environmental Concerns	3	4
Resourcefulness	3	3
Problem solving	2	3
Observation	4	4
Motivation	3	4
Control of One's Fate		3
Self-Confidence	3	3
Altruism	4	3
Autonomy	3	3
Ability to Make a Difference	2	3

Summary

Beth's reflections reveal her desire to learn through hands-on activities. She recognizes the beneficial outcomes of service learning. She frequently illustrates the content she has learned and its application to experiences outside academia. Her recollection of a conversation she had with a friend who recently traveled to Israel demonstrates this synthesis. Beth displays sensitivity to her own water consumption habits and commits to changing those habits. Her reflections also express a commitment to the community by stating that their role in our service project is essential to its success. Beth failed to identify additional skills she had learned from the seminar.

Pre and post semester content test scores further displayed Beth's successful retention of course content.

Unlike Melanie, Beth did not incorporate water quality terminology in her responses to the interest and concern inventories. Initially, Beth failed to provide a definition of "good water quality" on her fall pre-semester inventory. On her fall post-semester inventory, however, Beth employed a broad and general definition to define "good water quality". She also identified the distinction between service learning and community volunteering. Finally, Beth acknowledged a substantial contribution of our service project in clarifying course-related concepts.

Lucy

Lucy, a student from Pine Mountain Georgia, aspires to be a drama major. When asked why she registered for this freshmen seminar, Lucy stated: "It was an accident, actually. But, I do have concerns for the environment". Lucy appeared disengaged from the seminar and her peers throughout the semester. She frequently missed class. Lucy was the only one who did not attend our fall semester canoe trip.

Reflections

Lucy expresses a preference for applied forms of learning. She states:

> " I learn better when I'm actually out doing what I'm learning. I think it's great that we will be doing something to better our community. I've

> always been real involved with various community service projects and although community service is different they both allow you to serve the community. And what's great about service learning is that it allows you to learn in the process. "

In this quote Lucy acknowledges the educational aspect of service learning. Although she accurately notes one of the differences between community service and service learning, her view of the service aspect of service learning is largely client-based as opposed to a mutually beneficial relationship.

Lucy reflects on her own water consumption habits in the following quote:

> "I also used to be more concerned with wasting water. I say "used" to be because I kind of stopped thinking about it and I've become more wasteful. But, I used to turn off the water whenever I was brushing my teeth or I'd make sure that if I saw water dripping out of a faucet I'd turn it completely off. Just little things like that. But, I must admit that I've become more wasteful over the years. Since I'm in this class I'm going to try to get back to my old ways."

Although there is no indication for why Lucy digressed in her water conservation habits, she explains that she will attempt to return to these habits.

When asked to consider the layout of our video project, Lucy states that:

> "I definitely think that we should show the dump site on it and if possible the dump trucks being washed [out by] the river. That would really get people going. I know that it's probably a sensitive subject but that shouldn't be happening and if we know that it is then we should do something about it."

Here, Lucy expresses an obligation to inform our community about land uses that may impact human health and safety. According to Lucy, our class has the responsibility to use our newly acquired knowledge in an appropriate manner.

As her contribution to our class video project, Lucy chose to research the homeless camp situated along the North Oconee River. In a reflection, she states:

> "I'm having a hard enough time trying to find the homeless shelters in Athens myself and I have all the modern conveniences that make that sort of thing simple"

Here, she identifies the technology discrepancies that exist between herself and homeless individuals. She further alludes to the difficulties that homeless people may have in finding homeless shelters when their access to technology is limited.

Lucy also reflected on the different skills she had acquired throughout the semester. She stated that she learned different "ways of approaching a topic for research". Lucy also learned a lot about homeless people and the "many groups that are willing to help with the problem of [homelessness]".

Pre-post Content Test

Lucy indicated only one correctly informed answer on her fall pre-semester content test. She correctly guessed on three questions and incorrectly guessed on ten questions. Lucy gave one wrongly informed answer on her fall pre-semester content test.

Lucy's fall post-semester content test yielded eight correctly informed responses. She incorrectly guessed on two questions and gave five wrongly informed answers. (Table 3.1)

Table 3.1 Lucy's Content Test Results

	Right-Informed	Right- Guess	Wrong-Informed	Wrong- Guess
Fall pre-test	1	3	1	10
Fall post-test	8	0	5	2

From the above table, 7% of Lucy's fall pre-semester content test responses were correctly informed. 53% of her fall post-semester content test responses were correctly informed. Over the course of the fall semester, Lucy's scores reflect a 46% increase in correctly informed responses.

Inventories

On the fall pre-semester inventory, Lucy defined service learning as "helping the community while also learning". Lucy defined "good water quality" as that which is

“without any contaminates”. When asked to share her greatest water quality concerns Lucy cited the contamination roles of “big companies”. She elaborated further by stating “we only have so much water we don’t need people messing it up”. Lucy stated that water quality impacts are a result of “rain, soil, big companies”.

On the fall post-semester inventory, Lucy acknowledged a difference between service learning and community volunteering. She explained “service learning isn’t just doing something to help, it is also learning through helping”.

Lucy indicated that the service component of the seminar clarified eleven out of eleven listed course-related concepts/issues for her. She stated that the service learning project not only allowed her to “learn about the Oconee and how it is being polluted” but also allowed her to do “something about it”. In addition to enhancing her classroom education, Lucy declared that the service project helped her learn about the community.

On her fall post-semester inventory, Lucy defined “good water quality” as “a mountain stream, water that hasn’t been polluted by humans and the things that we build or change”. Her greatest water quality concerns involved how “big companies hide the pollution that they’ve done to the water”. She explained that water quality was impacted by “humans, our buildings, farms, cars, sewage”.

Between her fall pre and post-semester inventories, Lucy indicated an increase in rank for two of the seventeen character concepts. These included reflective thinking and self-confidence. Seven character traits declined in ranking from pre to post semester inventories. Lucy’s rankings remained the same for eight of the character traits.(Table 3.2)

Table 3.2 Lucy's Character Rankings

	Fall pre-semester	Fall post semester
Team-building	4	3
Team work	4	4
Leadership	3	2
Reflective Thinking	2	4
Community Concerns	3	3
Civic Responsibility	4	3
Self awareness	4	3
Environmental Concerns	4	3
Resourcefulness	3	2
Problem solving	2	2
Observation	2	2
Motivation	3	3
Control of One's Fate	3	3
Self-Confidence	3	4
Altruism	4	4
Autonomy	3.5	3
Ability to Make a Difference	3	3

Summary

Lucy's reflections reveal her preference for applied forms of learning such as service learning. In one of her earlier reflections, Lucy successfully acknowledges the difference between service learning and volunteering. Lucy's reflections rarely demonstrate her understanding of course content and its application to experiences outside of academia. She does, however, express a desire to change her own water consumption habits. This desire demonstrates a sense of stewardship. Lucy acknowledges a commitment to the community when she reflects on our potential class project. In one reflection, Lucy states that we have a duty to inform the Athens community about land uses occurring along the North Oconee River. Finally, Lucy states that she has acquired additional research skills and a greater awareness of the services available to homeless individuals from our seminar.

Lucy's pre and post semester content test scores indicate a 46% increase in her course-content retention rate.

Lucy's definition of "good water quality" varied little from her fall pre to post-semester inventories. Neither definition employed water quality terminology. Instead, both definitions were largely vague. Lucy's fall post-semester inventory definition did acknowledge the role of land use in contributing to water quality. Lucy correctly identified the distinction between service learning and community volunteering. Finally, Lucy acknowledged a substantial contribution of our service project in clarifying course-related concepts.

Susan

Susan, a student from Washington, Georgia, was the only non-traditional student in the seminar. She hopes to receive a bachelors in Middle School Education. Susan enrolled in the seminar because she "thought it would be interesting and [would] help [her] when [she's] in the field as a teacher". In addition to taking classes, Susan works as an office manager for a department at the University of Georgia and supports her husband and two children. She was confident and outspoken and had a great repertoire with the other students. Susan enrolled for the spring semester but had to withdraw from the seminar. She did however participate in class activities and canoe trips when possible.

Reflections

In a reflection about service learning pedagogy, Susan states:

> "My initial thought is that service learning seems fascinating and enjoyable. I feel that I learn best visually. I like to be involved with projects that satisfy my desire to learn and also give me an opportunity to take what I have learned and put it into practice…I had always assumed that community service and service learning were the same. It was interesting to learn that there are many similarities but the end result is very different. I believe that this course, even though not initially interested in water quality, will not only satisfy my learning desires, but heighten my interest in something that directly affects every community, not just my community. I have already learned things that I did not know-such as that we are in a drought, not necessarily because we haven't had rain, but because the ground has no moisture reserves due to the lack of rain."

Here Susan expresses a desire to learn in an applied manner. She then acknowledges that service learning is different from community service and also demonstrates awareness of new content knowledge. Susan also demonstrates her openness to exploring new subject matters in this quote.

Susan shares the impact of the seminar on her actions by stating:

> "After only three class sessions, my awareness of water quality has been heightened. I am beginning to take notice of water when I see it and what my initial thoughts are regarding the quality of the water. I do not know if my initial reactions are correct because I am only looking at the surface, but I would think that the surface and surrounding area give you a very good idea about the water quality."

With a new awareness for water resources and how land uses impact water quality, Susan wonders if her observations and water quality conclusions are correct. In this quote, she demonstrates a true application of knowledge.

Susan also demonstrates the connections she has made between the seminar and her everyday life in the following quote:

> "Decisions that we make regarding water usage does not just affect us, it affects our neighbors downstream. I think we have to be careful about growth in all areas, so that one area doesn't over tax the use of water resources. For instance, as the urban areas continue to grow, water usage increases. So what happens to the farmers in rural areas downstream?…I know that the county I live in is under a water restriction, but I still see people watering when they are not supposed to. Are these people thinking about how this affects their neighbors- I do not think so. I think the bottom line is that we must work together to come up with viable solutions to any and all water issues."

Susan expresses a need for conscientious water use. She indirectly alludes to a citizen responsibility to protect the water quality and quantity of downstream users. Susan suggests that viable solutions exist to protect the water needs of all users.

In one of her final reflections, Susan comments on the self-awareness that has occurred during the seminar. She states:

> "I have learned that I desire to make the environment around me clean. Things such as…washing my car have never been given a thought until this class, now have made me take a second look at things I do."

Pre-post Content Test

Susan indicated only one correctly informed answer on her fall pre-semester content test. She correctly guessed on four questions and incorrectly guessed on ten questions. She did not indicate any wrongly informed answers.

Susan's fall post-semester content test yielded eight correctly informed responses. She correctly guessed on one question and incorrectly guessed on three questions. Susan gave three wrongly informed answers. (Table 4.1)

Table 4.1 Susan's Content Test Results

	Right-Informed	Right- Guess	Wrong-Informed	Wrong- Guess
Fall pre-test	1	4	0	10
Fall post-test	8	1	3	3
Spring post-test	12	0	3	0

From the above table, 7% of Susan's fall pre-semester content test responses were correctly informed. 53% of her fall post-semester content test responses were correctly informed. By the spring post-semester content test, Susan's correctly informed responses grew to 80%. Over the course of both the fall and spring semesters, Susan's scores reflected a 73% increase in correctly informed responses.

Inventories

On the fall pre-semester inventory, Susan defined service learning as "what we can do to help make our world a better place to live". Susan defined "good water quality" as that which is "safe to drink and bathe in without fear of disease or unnecessary chemicals". When asked to share her greatest water quality concerns Susan cited three issues. They included "1. How much purification [water] goes through, 2. The

amount of chemicals I can taste in it, and 3. What chemicals do to my body." Susan stated that "what goes into the water, the land around the water" impacts water quality.

On the fall post-semester inventory, Susan stated that there was a difference between service learning and community volunteering. She explained "service learning involves producing a product that will tie back into what was learned".

Susan indicated that the service component of the seminar clarified five out of eleven listed course-related concepts/issues for her. Specifically, clarification occurred in the watershed concept, impact of land use on water quality, service learning approach to education, role of vegetation in protecting water quality and the connection between water quality and biological/aquatic life. She stated that the service learning project allowed her to "see what we have learned, benefit others, and be able to share ideas". In addition to enhancing her classroom education, Susan declared that the service project helped her learn about the community. She also expressed a desire to engage in a similar service project in her own community.

On her fall post-semester inventory, Susan defined "good water quality" as that which "we can drink from and let our children play in without worrying about after effects". She expressed her greatest water quality concerns by stating " I don't know how much can realistically be done to improve it without the community as a whole getting actively involved". She broadly stated that water quality was impacted by "everything!".

The spring post-semester inventory asked Susan to explain three things she might do if she saw a landfill bordering a river in her hometown. Susan stated that she would check for water contamination, work with community leaders to protect the river, and start a river protection committee. She identified her preferred method of action by stating "if the river and landfill were already in place, I would work through community leaders to make them informed of potential hazards."

Susan stated that "having to withdraw" was the most difficult part of the seminar for her. When asked what insights she had gained into people and their role in protecting our water resources, Susan said "these folks have an interesting and demanding job".

Similar to the fall pre and post-semester inventories, the spring post-semester inventory asked students to rank themselves on seventeen different character concepts. The difference, however, is that spring semester students received their fall pre-semester inventory rankings. Spring students were asked to provide a rationale for their spring rankings in light of their fall pre-semester rankings. Additional room was provided on the inventory for student comments but few students gave a rationale for their spring rankings. Susan did not provide a rationale for any of the seventeen characteristics.

For spring students, ranking generalizations are made based on fall pre-semester and spring post-semester inventory responses. Susan only indicated an increase in rank for the environmental concerns concept. No character traits declined in ranking. Susan's rankings remained the same for sixteen of the character traits. (Table 4.2)

Table 4.2 Susan's Character Rankings

	Fall pre-semester	Fall post semester	Spring post semester
Team-building	3	4	3
Team work	3	4	3
Leadership	3	3	3
Reflective Thinking	4	3	4
Community Concerns	2	3	2
Civic Responsibility	2	3	2
Self awareness	4	3	4
Environmental Concerns	2	3	3
Resourcefulness	3	3	3
Problem solving	3	3	3
Observation	3	3	3
Motivation	3	3	3
Control of One's Fate	4	4	4
Self-Confidence	4	4	4
Altruism	4	4	4
Autonomy	4	4	4
Ability to Make a Difference	4	4	4

Summary

In early reflections, Susan reports that service learning should fulfill her learning needs. She states a preference for applied forms of learning and correctly acknowledges a difference between service learning and community service. Susan frequently illustrates the content she has learned and its application to experiences outside academia. Her reflection on Georgia's drought and the outdoor watering practices of her neighbors demonstrates this synthesis. Although Susan does not specifically comment on changes to her physical use of water, she does demonstrate a change in the way she perceives water use and water quality. She also expresses sensitivity for downstream communities and a sense of environmental stewardship. Susan failed to identify additional skills she had acquired from the seminar.

Pre and post semester content test scores displayed Susan's retention of course content.

Susan did not incorporate water quality terminology in her interest and concern inventory responses. Her definition of "good water quality" remained largely the same for both fall pre and post-semester inventories. Susan's "water quality concerns" evolved over the course of the semester. On the fall pre-semester inventory, Susan listed three issues that concerned her the most. On her fall post-semester inventory, Susan expresses her water quality concerns in light of community participation. Instead of offering specific concerns like she did in the fall pre-semester inventory, Susan questions our ability to improve water quality unless communities become actively involved. This comment illustrates a growth in Susan's perception and defined role of community participation. Susan correctly identifies the distinction between service learning and community volunteering. She also acknowledged the contribution of our service project in clarifying course-related concepts. Finally, Susan's spring post-semester inventory continued to demonstrate her ability to apply course-based content. Her commitment to her role in protecting water resources, however, is less clear than earlier inventory responses.

Amber

Amber, a student from Cobb County, lives near the Chattahoochee River. In the past, she had volunteered with Keep America Beautiful. Amber enrolled in the seminar because her advisor advised her to do so. She was a conscientious student who worked hard to fulfill her own expectations and those of the class. In addition to classroom reflections and other requirements, Amber would often email me asking me to validate different connections she had made. Amber was a hard worker and always willing to try new experiences. She was one of three students to complete the spring seminar.

Reflections

Amber expresses her opinion of service learning by stating that:

> "The things I learn while doing service learning will stick in my mind [for] a long time because ideas put into action have [greater] meaning to me than those just written on paper."

In this quote, Amber explains that her retention rate is greater when she has the opportunity to apply her classroom knowledge.

Amber entered the seminar with a sensitivity for water conservation. In the following reflection entry, Amber credits her mother for her conservation habits.

> "My mom…always got onto me and my dad about the way we wasted water. Since then, I no longer keep the water running while I brush my teeth. I conserve water by cutting down on the excess water I use trying to [remove] the soap [from cleaned] dishes. Using less water to clean the dishes caused me to use less soap."

After the float trip on the North Oconee River, Amber wrote:

> "I was absolutely amazed to see how the trash from the landfill made up the river bank. It makes me wonder, how long the river bank [has] been that way? Is there important information about [possible] contaminants [originating] from the landfill? And how is wildlife around the river being protected?"

Here, Amber questions the history and potential chemical and biological contamination caused by the landfill. This demonstrates her interdisciplinary processing skills.

Amber's reflections testify to her community and environmental commitments. She states:

> "The condition of the water starts with me. I need to cut down on [my] shower time. I need to pay close attention to how I dispose of chemicals."

Here she acknowledges her own responsibilities in maintaining and protecting water resources. She later identifies these responsibilities as those held by the community as a whole. She argues that:

> "The monitoring of water starts with citizens. They have the power to expose serious problems."

She continues in another entry by saying:

> "I personally get upset when I hear somebody say that they don't really care about the effects they have on [our] water [resources]. Especially students at the university of Georgia [who believe that] they will only be in Athens for four years and [therefore] the water condition[s] here do not affect them. They don't realize that they have [an] affect on water condition wherever they are and should do their part to help enhance it."

In these quotes, Amber argues that all individuals should be active citizens wherever they live. This applies to even the most transient populations. According to Amber, even students have a responsibility to reconsider and change their water consumption habits.

Throughout the semester, Amber also reflected on the different skills she had acquired. In one reflection, she comments that she has "learned how to canoe". She also states that she " has learned more about Athens ".

Pre-post Content Test

Amber failed to indicate any correctly informed answers on her fall pre-semester content test. She correctly guessed on three questions and incorrectly guessed on twelve questions. She did not indicated any wrongly informed answers.

Amber's fall post-semester content test yielded two correctly informed responses. She correctly guessed on three questions and incorrectly guessed on seven questions. Amber gave three wrongly informed answers.

On the spring post-semester content test, Amber indicated seven correctly informed answers. She correctly guessed on three questions and incorrectly guessed on one question. Amber gave four wrongly informed answers. (Table 5.1)

Table 5.1 Amber's Content Test Results

	Right-Informed	Right- Guess	Wrong-Informed	Wrong- Guess
Fall pre-test	0	3	0	12
Fall post-test	2	3	3	7
Spring post-test	7	3	4	1

From the above table, 0% of Amber's fall pre-semester content test responses were correctly informed. 13% of her fall post-semester content test responses were correctly informed. By the spring post-semester content test, Amber's correctly informed responses grew to 47%. Over the course of both the fall and spring semesters, Amber's scores reflected a 47% increase in correctly informed responses.

Inventories

On the fall pre-semester inventory, Amber defined service learning as "learning how to protect our earth". She defined "good water quality" as that which is "drinkable". Amber stated that the cleanliness of water is what concerns her most about water quality. She broadly stated that human pollution impacts water quality.

On the fall post-semester inventory, Amber acknowledged a difference between service learning and community volunteering. She explained that "service learning lets you learn as you do service".

Amber indicated that the service component of the seminar clarified eight out of eleven listed course-related concepts/issues for her. Specifically, clarification occurred in the watershed concept, indications of water quality contaminates, impact of land use on water quality, service learning approach to education, role of vegetation in protecting water quality, non-point vs. point source pollution, connection between water quality and biological/aquatic life, and available water sources for Georgians. In addition to enhancing her classroom education, Amber declared that the service project helped her learn about the community.

On her fall post-semester inventory, Amber defined "good water quality" as that which meets the established regulations. When asked what concerns her most about water quality, Amber stated that "the things we put into water concerns me most because we all have to use it, even wildlife". She broadly stated that water quality was impacted by human use.

The spring post-semester inventory asked Amber to explain what she might do if she saw a landfill bordering a river in her hometown. Amber stated that she would contact her local politician, get involved in a group, or start a petition. She identified her preferred method of action by further declaring that she would "start a petition to turn in to somebody in charge to let them know that the people in the community are against it".

Amber stated that getting things done in a timely manner was the most difficult part of the seminar for her. When asked what insights she had gained into people and their role in protecting our water resources, Amber said" it is important for all people to get involved in protecting our environment. Even if that means signing a petition".

As mentioned earlier, spring students received their fall pre-semester inventory rankings on their spring post-semester inventories. Spring students were asked to provide a rationale for their spring rankings in light of their fall pre-semester rankings. Amber provided a rationale for two of the seventeen characteristics. In reference to team-building, Amber wrote "last fall, I should have chosen 2 or 3". For civic responsibility, Amber stated "I see there is so much more I should do (I feel I should do) as a citizen".

For spring students, ranking generalizations are made based on fall pre-semester and spring post-semester inventory responses. Amber indicated an increase in rank for three of the seventeen character concepts. These included civic responsibility, resourcefulness, and observation. No character traits declined in ranking. Amber's rankings remained the same for fourteen of the character traits. (Table 5.2)

Table 5.2 Amber's Character Rankings

	Fall pre-semester	Fall post semester	Spring post semester
Team-building	4	2	4
Team work	4	3	4
Leadership	3	2	3
Reflective Thinking	3	3	3
Community Concerns	3	3	3
Civic Responsibility	2	4	3
Self awareness	4	4	4
Environmental Concerns	4	3	4
Resourcefulness	2	2	3
Problem solving	3	2	3
Observation		3	3
Motivation	3	4	3
Control of One's Fate	4	3	4
Self-Confidence	4	3	4
Altruism	4	4	4
Autonomy	3	3	3
Ability to Make a Difference	4	4	4

Summary

Amber reports that applied forms of learning help her to retain information. Her reflections demonstrate the content she has learned and its application to experiences outside of academia. Amber's reflection on the North Oconee landfill and its water quality implications demonstrates this synthesis. Out of seven students, Amber is the only one who regularly practices water conservation habits. Her reflections indicate no additional water consumption changes. Amber's reflections hint to her perception of communities. She expresses faith in a community's ability to monitor its waters and

expose environmental problems. Amber also expresses a clear commitment to protecting our water resources. In fact in one reflection, she declares her frustration with those who do not share her strong environmental stewardship. Amber credited the seminars for her additionally acquired canoeing skills and greater awareness of the Athens community.

Fall and spring content test scores displayed Amber's growing retention of course content.ss

Amber did not incorporate water quality terminology in her interest and concern inventory responses. However on her fall post-semester inventory, Amber defined "good water quality", as that which met established regulations. This definition was likely triggered by the spring lecture on the Clean Water Act. Amber broadly identified human pollution as the source of water quality impacts on both fall pre and post-semester inventories. She correctly identified the distinction between service learning and community volunteering. Amber also acknowledged the contribution of our service project in clarifying course-related concepts. Finally, Amber's spring post-semester inventory continued to demonstrate her ability to apply course-based content and her commitment to her role in protecting water resources.

Aaron

Aaron, a student from Moultrie, Georgia, was the only male in the seminar. Aaron grew up near the Flint River where he used to water ski, raft, and canoe. Undecided in his major, Aaron registered for the seminar to explore majors. Aaron's reflections, concern and interest inventories, and other forms of feedback always displayed thoughtful consideration of the questions asked. He was a quiet leader and gained the respect of everyone in the class. He too completed the spring seminar.

Reflections

Aaron's reflections revealed a preference for hands-on learning. He states

> "It is interesting to me that we will actually be doing something not only productive as far as learning goes, but also something that has potential to benefit the community if only just a little bit… I learn best when I am

> actually doing something. That way, I can remember it because I have an experience to associate it with."

Aaron also demonstrates self-reflection and an embodiment of classroom knowledge in his reflections. When asked to consider the ways he uses water, Aaron stated:

> "Whenever I have used water in a way that seems like I could be ruining the water, I have thought about it…even [when doing] things like washing cars. I don't think I use water in a bad way, but then again I don't know the extent of what is bad."

In this quote, Aaron begins to consider his own practices in light of the recent lecture on the earth's hydrologic cycle. He acknowledges that his water use habits may impact water quality yet he also acknowledges that he needs more information to fully understand the potential repercussions of his actions.

Following the fall canoe trip on the North Oconee River, Aaron's reflection demonstrates his frustration and concern regarding a closed landfill bordering the river.

> "It seems like somebody must know that the banks are made up of waste and that the water quality gets worse and worse as the river flows…It really just doesn't make sense to me how we as a community could let this type of situation get out of hand. I guess that I can understand when people don't even know about the situation, but it is hard for me to believe that nobody knew about this. I think the case may be more like somebody chose to ignore the situation in which case, I think it is somebody's responsibility to expose that person. Maybe we can do that. I don't know. I think it is obvious that something needs to be done."

Here, Aaron struggles to place blame on a responsible individual. According to Aaron, the responsible party should be required to remedy the situation. Now that Aaron knows about the decrepit landfill, he voices a clear desire to help address the situation.

Aaron's reflections indicate a commitment to the community. While mulling over project ideas, Aaron writes:

> "Personally, I like cleaning something up and feeling the satisfaction of seeing how good it looks but I don't know how helpful that would be [for] the community."

Here, Aaron acknowledges that the community for which he is assisting does not necessarily share his definition of a desirable project.

Finally, Aaron comments on his academic and interpersonal growth by stating:

> "As crazy as it may seem, I had never really done in depth research on the internet [before]. "
> "I am learning how to work in a small group and how to depend on another person to do their part of the project."

These quotes illustrate the additional skills Aaron has acquired throughout the semesters.

Pre-post Content Test

Aaron indicated one correctly informed answer on his fall pre-semester content test. He correctly guessed on five questions and incorrectly guessed on eight questions. He indicated one wrongly informed answer.

Aaron's fall post-semester content test yielded eleven correctly informed responses. He correctly guessed on one question and incorrectly guessed on two questions. Aaron gave one wrongly informed answer on his fall post-semester content test.

On the spring post-semester content test, Aaron indicated twelve correctly informed answers. He incorrectly guessed on one question. Aaron gave two wrongly informed answers. (Table 6.1)

Table 6.1 Aaron's Content Test Results

	Right-Informed	Right- Guess	Wrong-Informed	Wrong- Guess
Fall pre-test	1	5	1	8
Fall post-test	11	1	1	2
Spring post-test	12	0	2	1

From the above table, 7% of Aaron's fall pre-semester content test responses were correctly informed. 73% of his fall post-semester content test responses were correctly informed. By the spring post-semester content test, Aaron's correctly informed responses

grew to 80%. Over the course of both the fall and spring semesters, Aaron's scores reflected a 73% increase in correctly informed responses.

Inventories

On the fall pre-semester inventory, Aaron did not provide a definition of service learning. Instead, he stated that "this is the first time I have encountered the term". He defined "good water quality" as that which is "clean or safe enough to swim and play in". Aaron identified people's thoughtless acts of pollution as his largest water quality concern. He did not respond to the "What impacts water quality" question.

On the fall post-semester inventory, Aaron acknowledged a difference between service learning and community volunteering. He stated "service learning is a combination between learning material and actually doing something about it. [It involves] creating a project that helps you learn about what you are doing while helping out".

Aaron indicated that the service component of the seminar clarified six out of eleven listed course-related concepts/issues for him. Specifically, clarification occurred with the watershed concept, indications of water quality contaminates, impact of land use on water quality, service learning approach to education, non-point vs. point source pollution, and available water sources for Georgians. In addition to enhancing his classroom education, Aaron declared that the service project helped him learn about the community.

On his fall post-semester inventory, Aaron defined "good water quality" as "pretty much just a term and not a fact these days. It is water that has low turbidity and the right levels of stuff we tested for like nitrate and phosphate". When asked what concerns him most about water quality, Aaron stated "that people can ignore the problem so easily. They just push it on the next generation when really it is a problem right now". He stated that water quality was impacted by "many things, mainly point and non-point source pollution. [This may include] car wash run-off or discharge from a plant".

The spring post-semester inventory asked Aaron to explain what he might do if he saw a landfill bordering a river in his hometown. Aaron stated that he would "notify or inquire to the proper authorities, raise awareness to the proper people who would get things done, or find a workable solution to the problem". He identified his preferred method of action by further declaring that he would " inform the right people". According to Aaron, this action "is almost guaranteed, especially in a small town".

When asked to identify the most difficult part of the seminar, Aaron stated that he didn't find anything difficult. He continued by stating " I have thoroughly enjoyed this class". Aaron was also asked what insights he had gained into people and their role in protecting our water resources. He stated " I have learned a lot about simple things I can do and how much impact the public really has on the quality of our water".

As mentioned earlier, spring students received their fall pre-semester inventory rankings on their spring post-semester inventories. Spring students were asked to provide a rationale for their spring rankings in light of their fall pre-semester rankings. Aaron provided a rationale for three of the seventeen characteristics. In reference to community concerns, Aaron wrote "I have definitely learned more about Athens because of the study we did on the North Oconee River". For civic responsibility, Aaron stated "After seeing how bad the river actually is, I feel a large responsibility to do more". In reference to environmental concerns, Aaron wrote "I love being outside and in water. Now that I know more about what can be done that's not being done, I am more concerned."

For spring students, ranking generalizations are made based on fall pre-semester and spring post-semester inventory responses. Aaron indicated an increase in rank for three of the seventeen character concepts. These included community concerns, civic responsibility, and environmental concerns. No character traits declined in ranking. Aaron's rankings remained the same for fourteen of the character traits. (Table 6.2)

Table 6.2 Aaron's Character Rankings

	Fall pre-semester	Fall post semester	Spring post semester
Team-building	4	4	4
Team work	4	4	4
Leadership	4	4	4
Reflective Thinking	4	3	4
Community Concerns	3	4	4
Civic Responsibility	3	3	4
Self awareness	4	4	4
Environmental Concerns	3	3	4
Resourcefulness	3	4	3
Problem solving	3	4	3
Observation	3	4	3
Motivation	4	3	4
Control of One's Fate	4	4	4
Self-Confidence	4	3	4
Altruism	4	4	4
Autonomy	4	3	4
Ability to Make a Difference	4	3.5	4

Summary

Aaron's reflections express his preference for applied forms of learning. He explains that hands on activities help him retain information. His reflections also demonstrate the content he has learned and its application to experiences outside of academia. Aaron's reflection on his water consumption habits and their potential implications illustrate this synthesis. Although Aaron makes no reference to changes in his physical use of water, he does illustrate a change in the way he perceives water use and water quality. Aaron also expresses a sincere commitment to the community. This is displayed in his efforts to identify a service project that will truly benefit the community. Aaron's reflections reveal a sense of environmental stewardship. He also credits the seminars for his additionally acquired internet research skills and his ability to perform group work.

Fall and spring content test scores displayed Aaron's growing retention of course content. Out of seven students, Aaron received the greatest score improvement.

Aaron incorporated water quality terminology in his interest and concern inventory responses. On his fall pre-semester inventory he offered a general definition for "good water quality". However on his fall post-semester inventory, Aaron relied on water quality terminology such as turbidity, nitrate, and phosphate to define "good water quality". Aaron failed to offer any ideas concerning water quality impacts on his fall pre-semester inventory. However, his fall post-semester inventory referred to point and non-point sources of pollution as impacts to water quality. Aaron correctly identified the distinction between service learning and community volunteering. He also acknowledged the contribution of our service project in clarifying course-related concepts. Finally, Aaron's spring post-semester inventory continued to demonstrate his ability to apply course-based content and his commitment to his role in protecting our water resources.

Hillary

Hillary, a student from Darien, Georgia, grew up along the estuaries of the Altamaha River. She fondly recalls helping her father, a shrimper of 22 years, on his boat. Hillary, the first one in her family to attend a university, aspires to major in either veterinarian medicine or marine science. She enrolled in the seminar "to learn more about the environment and water quality of Georgia". She was confident in her abilities and befriended many of the students in the seminar. She completed the spring seminar.

Reflections

Hillary also voiced a preference to learn in an applied manner. She states:

> "I really think that if every class [had] a type of learning [similar to that of] service learning that it would be more interesting to the students. I really enjoy hands on experience and service learning allows you to have a closer bond to your work."

Hillary spoke of a direct correlation between classroom teachings and her own actions. She states:

> " I have recently noticed a change in the way I use water. I try to conserve water during my bathing time and while I am brushing my teeth or washing my dishes."

Hillary makes few references to the community's role in our project. When asked what she has learned in regards to the community, Hilary comments that:

> "I know that I can help the community by watching what I do. I can also get actively involved in helping others that don't have what I have".

Although Hillary acknowledges the contributions she can have in the community, the above quote hints to the charity orientation of service. Hilary continues to display the charity orientation when asked what she has learned about herself. She states:

> "I have learned that I am more willing to help others than I thought I was. I used to be pretty selfish. I did not realize all I had. I learned that I cannot always be perfect but as long as I am helping others, I am doing my part."

Pre-post Content Test

Hillary failed to indicate any correctly informed answers on her fall pre-semester content test. She correctly guessed on nine questions and incorrectly guessed on six questions. She did not indicate any wrongly informed answers.

Hillary's fall post-semester content test was largely incomplete. She answered all 15 multiple choice questions but failed to indicate whether or not her answers were informed or merely a guess on 13 questions. She only indicated a correctly informed answer on two questions. Yet, she correctly answered eleven questions. Hillary incorrectly answered 4 questions.

On the spring post-semester content test, Hillary indicated nine correctly informed answers. She correctly guessed on two questions and incorrectly guessed on two questions. Hillary gave two wrongly informed answers. (Table 7.1)

Table 7.1 Hillary's Content Test Results

	Right-Informed	Right- Guess	Wrong-Informed	Wrong- Guess
Fall pre-test	0	9	0	6
Fall post-test	Total Right=11 Right & Inform=2		Total Wrong= 4	
Spring post-test	9	2	2	2

From the above table, 0% of Hillary's fall pre-semester content test responses were correctly informed. Retention growth for the fall post-semester content test is not included because it is unclear how many responses were actually correctly informed. By the spring post-semester content test, Hillary's correctly informed responses grew to 60%. Over the course of both the fall and spring semesters, Hillary's scores reflected a 60% increase in correctly informed responses.

Inventories

On the fall pre-semester inventory, Hillary defined service learning as "applying your knowledge or gathering knowledge to solve a specific problem". She defined "good water quality" as that which is "clean and unpolluted". Hillary stated that the "depletion of important plants and animals and the water itself" is what concerns her most about water quality. She continued by stating that "all are needed to sustain life". She broadly stated that human waste impacts water quality.

On the fall post-semester inventory, Hillary acknowledged a difference between service learning and community volunteering. She explained that "in service learning you do research on a project to help you solve a problem".

Hillary indicated that the service component of the seminar clarified eleven out of eleven listed course-related concepts/issues for her. Hillary declared that the service project "helped us to learn more about water quality and to be involved". In addition to enhancing her classroom education, Hillary declared that the service project helped her learn about the Athens-Clarke County community.

On her fall post-semester inventory, Hillary defined "good water quality" as the overall state of well being of water". When asked to identify what concerns her most about water quality, Hillary stated that she was concerned that water would become

increasingly polluted. She broadly stated that water quality was impacted by "everything".

The spring post-semester inventory asked Hillary to explain what she might do if she saw a landfill bordering a river in her hometown. Hillary stated that she would "report or complain to county waste management, begin a petition to have it replaced, or report it to the newspaper and other important figures that would study the effects". She identified her preferred method of action by further declaring that she would "begin a petition because the county would have to relocate it if the studies showed it was harmful and people wanted them to relocate it".

Hillary stated that "coming up with ideas for the video and brochure were the most difficult part of the seminar for her. When asked what insights she had gained into people and their role in protecting our water resources, Hillary said "I have learned that there are people willing to help but not nearly enough".

As mentioned earlier, spring students received their fall pre-semester inventory rankings on their spring post-semester inventories. Spring students were asked to provide a rationale for their spring rankings in light of their fall pre-semester rankings. Hillary provided a rationale for only one of the seventeen characteristics. In reference to team-building, Hillary wrote "I have always been outgoing and willing to work with others".

For spring students, ranking generalizations are made based on fall pre-semester and spring post-semester inventory responses. Hillary did not indicate an increase in rank for any of the seventeen character concepts. In addition, no character traits declined in ranking. Hillary's rankings remained the same for all seventeen character traits. (Table 7.2)

Table 7.2 Hillary's Character Rankings

	Fall pre-semester	Fall post semester	Spring post semester
Team-building	4	3	4
Team work	4	4	4
Leadership	3	3	3
Reflective Thinking	3	3	3
Community Concerns	4	4	4
Civic Responsibility	4	4	4
Self awareness	4	4	4
Environmental Concerns	4	4	4
Resourcefulness	4	4	4
Problem solving	4	4	4
Observation	4	4	4
Motivation	3	3	3
Control of One's Fate	4	3	4
Self-Confidence	4	4	4
Altruism	4	4	4
Autonomy	4	4	4
Ability to Make a Difference	4	3	4

Summary

Hillary's reflections express her preference for applied forms of learning. She even suggests implementing service learning in other courses. Her reflections also demonstrate the influence of course-based instruction on her activities outside of academia. Hillary's reflection on her water consumption habits illustrates this synthesis. In more than one reflection, Hillary hints at her charity-oriented commitment to the community. She addresses her role as an environmental steward and demonstrates her sincerity through her water conservation habits. Hillary fails to credit the seminars with any other acquired skills.

Fall and spring content test scores displayed Hillary's growing retention of course content.

Hillary did not incorporate water quality terminology in her interest and concern inventory responses. On both her fall pre and post-semester inventories, Hillary defined

"good water quality" in general terms. Hillary also broadly identified the source of water quality impacts on both fall pre and post-semester inventories. She correctly identified the distinction between service learning and community volunteering. She also acknowledged the substantial contribution of our service project in clarifying course-related concepts. Finally, Hillary's spring post-semester inventory continued to demonstrate her ability to apply course-based content and her realization that citizens must play a larger role in protecting their resources.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The reality of today's environmental crisis has resulted in a clear need for environmental education initiatives at all levels. Future citizens must be equipped with a basic understanding of ecological principles. Exposing students to the interdisciplinary focus of environmental education may result in knowledgeable citizens who are more prepared to approach an unpredictable world and its problems.

In this study, a pedagogy known as service learning is offered as an educational approach to environmental education initiatives. Unlike traditional approaches to education, service learning focuses on the growth of the entire student. This includes the intellectual, cognitive, personal, and interpersonal growth of students. The purpose of this study was to explore whether or not service learning is an appropriate approach to environmental education.

To address this question, a seminar was developed and implemented at the University of Georgia's Institute of Ecology. The seminar was entitled "Living Upstream: Learning How To Serve Our Downstream Neighbors". It employed the service learning pedagogy in teaching a particular topic of environmental education. Together, seven students and two instructors explored general and specific water quality and quantity issues facing Georgia's Altamaha Watershed. Quantitative and qualitative research methods were used to assess student growth and development.

The following discussion illustrates the authenticity of the seminar study as it relates to the pedagogical components of service learning courses. The service outcomes of the seminar are then presented for both the community and the student participants. Learning outcomes are presented for student participants. Student reflections are then generalized to illustrate the philosophical aspect of service learning. Study implications

are presented followed by recommendations for future research. The chapter will conclude with a personal note.

Discussion

Service Learning Pedagogy

In order to answer my research question, it was necessary to determine whether the seminar was in actuality service learning. To determine this, I examined whether or not this seminar illustrates the six service learning program characteristics as outlined in chapter two by Eyler and Giles. Classroom lectures and field trips complemented the service project for effective *placement quality*. Students *applied* their water quality knowledge to address land use impacts occurring along the North Oconee River. They submitted written *reflections* that demonstrated their internalization of knowledge and its application outside the classroom. Students experienced *diversity* through their interaction with community members on float trips and through their exposure to new occupations such as video production and news reporters. *Community voice* was realized in the development of the seminar itself. It was further embodied in the creation of an educational video. Both the seminar and the video sought to promote citizen awareness of their watersheds. *Reciprocity* between the seminar participants and the community was encouraged. Community members assisted students with their research and provided feedback on storyboard drafts. In return, students participated in every aspect of video development.

Identification of the Service and the Learning Outcomes

I next thought to identify service and learning outcomes for the seminar. The study seminar resulted in service outcomes for the community. Student participants realized service and learning outcomes. The following paragraphs illustrate these outcomes.

Based on the request of the community, the students determined that a video highlighting the North Oconee River and its adjacent land uses would best fulfill community needs. The video served to promote citizen awareness of watersheds, urban

rivers, and the threats and promises facing today's rivers. Targeted audiences included local schools, religious groups, outdoor enthusiast, and others.

In addition to serving the community, the seminar promoted the growth and development of each student participant. According to interest and concern inventories, students most frequently indicated increased rankings for civic responsibility and environmental concerns. In fact, four students reported increased rankings for civic responsibility and three students reported increased rankings for environmental concerns. Motivation and self-confidence received increased rankings from two students. The seminar also provided a hands-on, applied learning environment for students. Most students recognized a preference for applied learning approaches.

As mentioned earlier, student retention was assessed using the one-group pretest-posttest design. Based on the results of this research method, all students demonstrated at least a 46% increase in their content test scores from the fall pre-semester content test to the fall or spring post-semester content test.

Service Learning Philosophy

In regards to service learning as a philosophy, recall Westheimer and Kahne's charity and change orientations as discussed in chapter two. Under the charity orientation, a volunteer ethic is promoted to develop responsible citizens. Services are preformed as acts of kindness as opposed to a sense of duty to one's community. However, under the change orientation, a mutually beneficial relationship between the recipient and the service provider is fostered. Here, service participants become critical thinking citizens who seek to struggle for progress along side the recipient. The focus is on collective transformation as opposed to complacency.

Melanie, Susan, and Amber's reflections hint to the change orientation. Their reflections express an obligation or duty to the community. They clearly recognize and express an active role in protecting our water resources. Reflections testify that this role extends beyond our classroom.

Orientation generalizations for Beth, Aaron, Lucy, and Hillary are more difficult to discern. Their reflections often express a detachment from water issues and the community as a whole. These students have appropriated water quality and quantity concerns to "the community". This detachment is illustrated in their reflections which simply state their willingness to "reconsider" their water consumption habits. There is little to no acknowledgement that as students, they are a part of the community. Instead, these students appear to believe that they are separate and removed entities. Therefore, they are largely unaffected by "community concerns".

These four students also appear to view participation in service learning as an act of kindness for the community. Hillary's desire to serve stems from her recognition of being privileged. On more than one occasion, Hillary comments that she should help the community because they "don't have what I have". Hillary fails to acknowledge that water contamination and shortages largely ignore societal distinctions of wealth, race, gender, educational training, and place of origin. Although her desire to serve is admirable, it is based largely on false premises and appears to lack a commitment to transformation. This is largely the case for Beth, Aaron, and Lucy as well.

In summary, students displayed elements of both the charity and change orientations. Some students clearly demonstrated a change orientation while generalizations for other students can be less certain.

Implications

Based on the results of this study, service learning is an appropriate approach to environmental education. It offers an applied educational approach that appeals to a variety of students. It results in marked educational benefits for students. It also fosters a student's personal growth and their sense of civic responsibility. Participating students may also embody one of two philosophical orientations that influence their current definition of citizenship and their future participation in communities. In addition to satisfying student needs, service learning environmental education courses result in the identification and fulfillment of community environmental needs.

The theoretical and practical implications of this study are great. Theoretically, service learning's holistic approach to student development and growth may compliment the interdisciplinary focus of environmental education. Service learning may also provide a more effective educational approach to reach the ends of an environmentally literate citizenry. In practice, service learning can be implemented in pre-existing environmental education courses in varying degrees.

Service learning offers a holistic approach to student growth and development that parallels the holistic and encompassing focus that environmental education as a discipline assumes. Educators cannot equip future citizens to effectively address environmental concerns by acknowledging isolated pieces of the problem. Instead, students must be encouraged to acknowledge the natural, social, political and ethical complexities inherent in environmental issues. Under the guidance of surrounding communities, instructors and institutions, service learning provides a safe venue for students to explore these complexities and experience "the real world".

Yet, service learning also encourages the intellectual, cognitive, personal, and interpersonal development of student participants. Unlike traditional forms of education that largely strive to hone student's intellectual capacity and memorization skills, service learning views the student as an entire entity to nurture. This holistic dedication to student development appropriately compliments the holistic focus of environmental education.

Service learning may also offer a means to an environmentally literate citizenship. Traditional forms of education measure student retention by a students ability to recall information. Service learning, however, provides an educational opportunity that encourages students to participate in every aspect of "thinking". This includes categorizing, translating, hypothesizing, valuing, generalizing, and synthesizing information. Although these abilities are crucial for all disciplines, environmentally literate citizens must embody these abilities to wisely and creatively respond to environmental issues confronting their lives daily.

Additionally, service learning encourages students to develop morally and cultivate their own definition of concepts like citizenship and civic responsibility. A student's self- conception is largely influenced through interactions within a complex social environment. Service learning provides the social interactions students need to evolve in their self-conceptions and defined roles in the community.

Service learning, therefore, offers a wholesome opportunity for citizens to gain the intellectual tools they need to understand our changing environment as well as the self- reflective, and analytical abilities necessary to begin behavioral changes. Together, these attributes may lead to an environmentally literate citizenship that is not only knowledgeable about environmental issues but also applies this knowledge to everyday life and everyday actions.

From a practical standpoint, service learning can be tailored to accommodate preexisting environmental education courses. For illustration purposes, consider a University's introductory course on environmental issues. Hypothetically, this course may explore the ecological concepts that form the basis for understanding environmental issues such as population growth, global climate change, and resource limitation. The course may include a 2 hour lecture and a 3 hour lab once a week. Typical enrollment is equivalent to two hundred students per semester.

Lab exercises allow students to explore environmental issues in small groups of up to 15 people. Occasionally lab exercises parallel class lectures. They may involve hands-on activities that demonstrate scientific techniques for studying phenomenon such as estimating population sizes and determining forest succession stages. All lab activities occur within a 10 miles radius of the University.

Instructors wishing to implement service learning in this pre-existing environmental issues course should first identify the degree to which service learning should play a role. Course designers could slowly integrate service learning into the course by first assessing community needs in relationship to existing lab exercises. Community needs could be identified in a brainstorming activity attended by community

members representing various environmental organizations, community groups, and local schools. At that time, community members should be introduced to the concept of service learning and its implications for the community and students.

Once community needs have been identified, the course designers should determine how to present related topics so that student understanding is fostered through the fulfillment of a service project. The application of student knowledge and the fulfillment of a community-identified need might occur in the designated lab sections. Following the exercise, students should be asked to reflect on issues such as their perception of the project and its contribution to the community.

In the hypothetical case above, the contribution of service learning is minimal. It would require the dedication of one to two lecture sessions. In these sessions, students should be introduced to the environmental issue at hand and to the concept of service learning. Depending on the corresponding service project, one to two lab sessions may be required to address student learning and community needs. Regardless of the extent to which service learning is implemented, course designers should ensure that the six program characteristics (e.g., placement quality, application, reflection, diversity, community voice, and reciprocity) are fully met.

Recommendations

While the data from this study suggests that service learning is an appropriate approach to environmental education, additional studies are recommended to further understand the role and contribution of this pedagogy

- Future studies should rely on experimental designs rather than the one-group pretest-posttest design. The one group post test design is often burdened by extraneous variables that make it difficult to attribute student content growth. These variables include history, maturation, testing, and experimental mortality. History refers to the specific events occurring between the first and second measurement. Many plausible events could have occurred during the duration of

the study that may have had an impact on test scores. For example, the trips down the North Oconee River were fundamental to understanding human effects on water quality. During the fall semester, Lucy was unable to attend the float trip. During the spring semester, Hillary was unable to attend. This may have impacted student retention and post-test scores. Yet another example was the co-enrollment of Aaron and Hillary in environmental health and marine science courses respectively. These additional courses reiterated many of the concepts discussed in the freshmen seminar for Aaron and Hillary. Maturation refers to those processes within the respondents operating as a function of the passage of time. In this study, each participant, either formally or informally, mentioned noticing more news features addressing water quality issues. Because this study took place over a period of time, the increase in scores may have been the result of the maturation of participants as they settled into university life, rather than the content they gained in the seminar. Testing refers to the effects of the pretest itself. Students taking a test for a second time generally do better than those taking the test for a first time. In this study, the same form was used as both the pretest and posttest. Although a time period of four months separated each test, it is not inconceivable that students did not remember the test items. Experimental mortality is the differential loss of respondents from the group. In this study, student participants declined from the fall to spring seminars. This drastically reduced the already small sample size of the study.

- Interest and concern inventories fashioned after those employed in this study should present pre-semester inventory rankings on post-semester inventories for each student. Student characteristic rankings on the fall pre and post-semester inventories varied greatly. Occasionally, students noted a large increase for some concepts (ex. Reflective Thinking → 2,4) while other concepts received a decrease in ranking (ex. Team Building → 4,2). A number of factors could

explain these disparities. Student self-esteem, stress level, and other personal issues might provide reasons for these discrepancies. However, in an effort to minimize speculation, students should have access to their pre-semester rankings and additional room on the inventory to provide a rationale for any rank changes. As mentioned in chapter four, this approach was employed for the spring seminar. Although students provided few rationales for their rank changes, this method attempts to diminish evaluator subjectivity.

- Service learning requires time commitments that often extend beyond the limits of a semester seminar. Service learning influences student learning when placement quality, application, reflection, diversity, community voice, and reciprocity are clear components of a program design. All of these components require a time investment. In this study, the fall seminar was extended into the spring semester due to student request. Those who completed the spring seminar gained increased exposure to the diversity, community and reciprocity components of the seminar. This exposure likely enhanced the education of those who continued in the spring. Spring students also witnessed the completion of the service project.

- Long-term studies may help to identify any lasting effects of service learning on students. Tracking students and their cognitive, personal, and interpersonal growth may testify or refute the attributes of service learning that are championed by practitioners. However, it may be difficult to credit future growth and changes to past service learning classes or programs.

Personal Note

My undergraduate career was spent at a small private college. Here, I participated in two service learning courses: “Hunger, Plenty, and Justice” and “South Africa”. Today, I largely credit these courses with my commitment to public service and quality

communities. I valued the service experiences offered by each course and found that they not only enhanced my education but they caused me to grow in a direction that I would not have found on my own. The reflective skills and values that I cultivated during my undergraduate career remain with me to this day. For that, I am indebted to the professors who had the courage and vision to offer alternative forms of education.

My reflective capabilities served me well as an instructor of service learning. During the study, I realized that my need for structure and organization had to be temporarily relinquished for an effective service learning experience. Although service learning is not without structural components, a strength of the approach is its flexibility and adaptability to different learning opportunities. Even though I anticipated this internal struggle prior to implementing the seminar, I felt that the potential benefits for the students outweighed any possible discomfort I might feel due to my compromised teaching personality.

I believe that all students should have the opportunity to enroll and experience a service learning course. Student's educational skills and needs vary tremendously. Because of this, educators must offer approaches that target and stimulate the skills that may lie dormant under traditional approaches. Providing service learning opportunities in academia may present disenfranchised students with the pride of success that has been yet untapped by traditional approaches. If this is a possibility, then as educators, we would be foolish not to offer this chance of achievement.

REFERENCES

Altamaha Riverkeeper (2001). http:// www.altamahariverkeeper.org

Batchelder, T.H., & Root, S. (1994). Effects of an undergraduate program to intergrate academic learning and service: cognitive, prosocial cognitive and identity outcomes. Journal of Adolescence, 17, 341-356.

Campbell, D. T., & Stanley, J. C. (1963). Experimental and quasi-experimental designs for research. Boston: Houghton Mifflin Company.

Chung, S. (2000). How to Storyboard. http://www.arches.uga.edu/~samchung/storyboard.html

Dewey, J. (1916). Democracy in education. In H. Silcox, A how to guide to reflection: Adding cognitive learning to community service programs (pp. 11-12). Philadelphia, PA: Brighton Press.

Dewey, J. (1933). School and society. (2nd ed.). Chicago: University of Chicago Press.

Dewey, J. (1946). "Search for the Great Community." In J. Dewey The Public and Its Problems. Chicago: Gateway Books.

Elder, J., Klyza, C.M., Northup, J., & Trombulak, S. (1999). Connecting with human and natural communities at middlebury college. In H. Ward & E. Zlotkowski, Acting locally: Concepts and models for service-learning in environmental studies (pp.133-144). Washington, DC: American Association for Higher Education.

Eyler, J., & Giles, D.E. (1999). Where's the learning in service-learning? San Francisco: Jossey-Bass Publishers.

Georgia Department of Natural Resources. (1989). Oconee River Basin Management Plan. Atlanta, GA: Georgia Environmental Protection Division.

Georgia Sea Grant College Program (2001). http://www.marsci.uga.edu/gaseagrant.html

Jacoby, B. (1996). Service learning in higher education: Concepts and practices. San Francisco: Jossey-Bass Publishers.

Jenks-Jay, N. (1999). Connecting the classroom and the community: A southern california experience. In H. Ward & E. Zlotkowski, Acting locally: concepts and models for service-learning in environmental studies (pp.133-144). Washington, DC: American Association for Higher Education.

Kendall, J.C. (1990). Combining service and learning: An introduction. In J.C. Kendall (ed.), Combining service and learning: A resource book for community and public service (p.23). Vol. 1. Raleigh, NC: National Society for Experiential Education.

Kolb, D.A. (1981). Learning styles and disciplinary differences. In A.W. Chickering and Associates, The modern american college. San Francisco: Jossey-Bass Publishers.

Korfmacher, K. (1998). Envs 301: Environmental Education. http://www.denison.edu/enviro/es301syll.html

Kundell, J. (1989). Land use history of Georgia from Land use policy and the protection of georgia's environment. Athens, GA: University of Georgia's Vinson Institute of Government.

LeTendre, B. G., & Lipka, R.P (1999). Getting answers to your questions: A middle level educator's guide to program evaluation. Norwood, MA: Christopher-Gordon Publishers Inc.

McEwen, M.K. (1996). Enhancing student learning and development through service learning. In B. Jacoby and Associates, Service-learning in higher education: Concepts and practice (pp. 53-92). San Francisco: Jossey-Bass Publishers

Merriam, S. B. (1988). Case study research in education: A qualitative approach. San Francisco: Jossey-Bass Publishers.

Merriam, S. B. (1992). Qualitative research and case study applications in education. San Francisco: Jossey-Bass Publishers.

Noddings, N. (1984). Caring: a feminine approach to ethics and moral education. Berkley: University of California Press.

Orr, D. (1992). Ecological literacy: education and the transition to a postmodern world. New York: State University of New York Press.

Raven, P. H., & Berg, L. R.(2001). Environment. Forth Worth, TX: Harcourt College Publishers.

Rhoads, R. (1998). Critical multiculturalism and service learning. In R. Rhoads & J. Howard (Eds.), Academic service learning: A pedagogy of action and reflection. San Francisco: Jossey-Bass Publishers.

Schine, J. (1997). Service learning: ninety-sixth yearbook of the national society for the study of education. Chicago: University of Chicago Press.

Silcox, H.(1993). A how to guide to reflection: Adding cognitive learning to community service programs. Philadelphia, PA: Brighton Press.

Sparks-Langer, Mohlman, G., & Colton, A.B. (1991). Synthesis of research on teachers' reflective thinking. In H. Silcox, A how to guide to reflection: adding cognitive learning to community service programs (pp.12-13). Philadelphia, PA: Brighton Press.

Westheimer, J. & Kahne, J. (1996). In the service of what? The politics of service learning. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans.

APPENDIX A

SEMESTER COURSE OUTLINES

Fall Semester Syllabus

Week One- August 22, 2000
Introduction to the Class

Week Two- August 29, 2000
Service Learning Overview
Journal Assignment

Week Three- September 5, 2000
Introduction to the 21st century oil → WATER
Journal Assignment

Week Four- September 12, 2000
Spotlight on Georgia
Journal Assignment

Week Five- September 16, 2000
Saturday **Float Trip**!

Week Six- September 19, 2000
Reflection time

Week Seven- September 26, 2000
Water Exploration
Journal Assignment

Week Eight- October 3, 2000
Democracy in Action
Journal Assignment

Week Nine- October 10, 2000
Project determination
Video Layout
Allocation of Student Research Tasks
Journal Assignment

Week Ten- October 17, 2000
Work Session
Continuation of Student Research Efforts
Journal Assignment

Week Eleven- October 24, 2000
Guest Speaker from Office of Instructional Support and Development
Journal Assignment

Week Twelve- October 31, 2000
Planning for Spring Semester
Journal Assignment

Week Thirteen- November 7, 2000
Individual Progress Reports
Journal Assignment

Week Fourteen- November 14, 2000
Draft Video Introduction
Journal Assignment

Week Fifteen- November 21, 2000
Guest Speaker: Kevin Hoth
Journal Assignment

Week Sixteen- December 5, 2000
Wrap up and Celebrate!

* Note: originally open class sections are indicated by underlined classroom activities

Spring Semester Syllabus

First meeting- January 13, 2001
Canoe the North Oconee to record video footage

Second Meeting- February 7, 2001
Review the video storyboard

Third Meeting- February 21, 2001
Guest lecture on the impacts of dams on riverine ecosystems
Journal Assignment

Fourth Meeting- March 14, 2001
Guest lecture on the Clean Water Act

Fifth Meeting- March 27, 2001
Develop brochure to accompany video

Sixth Meeting- April 21, 2001
Celebration float trip
Journal Assignment

Seventh Meeting- May 1, 2001
End of course evaluations

APPENDIX B

CONTENT TEST

Name: _____
Date: _____

FRES 1010 Living Upstream: Learning How To Serve
Our Downstream Neighbors
Elizabeth Pate
Gini Cogswell

1. The area of land that drains into a stream is called a:
    a. Basin
    b. Watershed
    c. Catchment
    d. All of the above

    1. This is an informed answer
    2. This is a guess

2. There are over 100 rare or endangered plant and animal species in the Altamaha River. Which of the following is NOT one of them?
    a. Swallow tailed kite
    b. Shortnose sturgeon
    c. Flathead Catfish
    d. Manatee

    1. This is an informed answer
    2. This is a guess

3. The Altamaha River system drains one fourth of Georgia. This includes:
    a. Athens, Macon, and parts of Albany
    b. Macon, Albany, and parts of Augusta
    c. Macon, Albany, and parts of Athens
    d. Athens, Macon, and parts of Atlanta

    1. This is an informed answer
    2. This is a guess

4. The following is NOT part of the hydrologic cycle:
    a. Transcription
    b. Evaporation
    c. Precipitation
    d. Runoff

    1. This is an informed answer
    2. This is a guess

5. Turbidity is a measure of:
    a. Temperature fluctuation
    b. Sediment contamination
    c. Oxygen content
    d. Total nitrate

    1. This is an informed answer
    2. This is a guess

6. In Athens, urban street waste flows into storm drains and then to:
    a. The sewage treatment plant
    b. An oxidation pond
    c. An artificial wetland
    d. The North and Middle Oconee

    1. This is an informed answer
    2. This is a guess

7. The following river is NOT part of the Altamaha Watershed:
    a. Ogeechee
    b. Ohoopee
    c. Middle Oconee
    d. Ocmulgee

    1. This is an informed answer
    2. This is a guess

8. Coastal Georgia residents primarily use water from:
    a. Etowah River
    b. Desalination Plants
    c. Floridian Aquifer
    d. Coastal Wetlands

    1. This is an informed answer
    2. This is a guess

9. Today, the most serious threat to water quality comes from:
    a. Point source pollution
    b. Non-point source pollution
    c. Pointless pollution
    d. All of the above

    1. This is an informed answer
    2. This is a guess

10. Roofs, sidewalks, and parking lots are all examples of _____ surfaces.
    a. Impervious
    b. Penetrable
    c. Pervious
    d. Impeccable

    1. This is an informed answer
    2. This is a guess

11. Fecal coliform contamination can come from all of the following BUT:
    a. Failing septic systems
    b. Pet waste
    c. Fish droppings
    d. Leaking sewers

    1. This is an informed answer
    2. This is a guess

12. One of the most effective ways to protect water quality from the negative impacts of land use activities is via:
    a. Silt fences
    b. Vegetated buffers
    c. Rip Rap
    d. Concrete lined stream beds

    1. This is an informed answer
    2. This is a guess

13. Most of the Earth's readily available fresh water comes from:
    a. Rivers and Streams
    b. Groundwater aquifers
    c. Freshwater Lakes
    d. Atmospheric Vapor

    1. This is an informed answer
    2. This is a guess

14. Worldwide, _____ consumes the most water:
    a. Households
    b. Industries
    c. Agriculture
    d. Municipalities

    1. This is an informed answer
    2. This is a guess

15. The following is an example of point source water pollution:
    a. Urban street run-off
    b. Mine Drainage
    c. Construction activities
    d. Sewage treatment plant discharge

    1. This is an informed answer
    2. This is a guess

APPENDIX C

INTEREST AND CONCERN INVENTORIES

Name: _____
Date: _____

Fall Pre-semester Inventory
Fall 2000

Living Upstream: Learning How to Serve
Our Downstream Neighbors
FRES 1010

Have you ever participated in service learning activities before this semester?

Have you ever participated in environmental advocacy work before? If so, describe your activities.

What is your definition of service learning?

What concerns you most about water quality? Why?

What is "good water quality"?

What impacts water quality?

Why did you register for this Freshmen Seminar?

Please circle the number that corresponds with how you would rank yourself regarding these concepts at **this time in this class**:

Ranking

	Excellent	Good	Fair	Poor
Team-building	4	3	2	1
• Ability to participate in collaborative activities to address a common goal				
Team work	4	3	2	1
• Collaborative effort by members of a group to achieve a common goal				
Leadership	4	3	2	1
• Capacity or ability to guide				
Reflective Thinking	4	3	2	1
• Careful and thoughtful consideration				
Community Concerns	4	3	2	1
• Understanding concerns and issues applicable to one's community				
Civic Responsibility	4	3	2	1
• Possessing a duty or obligation as a citizen for one's surrounding community				
Self-awareness	4	3	2	1
• Recognition of oneself as an individual entity or personality				
Environmental Concerns	4	3	2	1
• An interest in the state of our environment				
Resourcefulness	4	3	2	1
• Capable of acting effectively or imaginatively, especially in difficult situations				
Problem Solving	4	3	2	1
• The ability to work out a difficult / uncertain question or situation				
Observation	4	3	2	1
• The act of noting something resulting in an inference or judgment that is acquired from or based on observing				
Motivation	4	3	2	1
• The act of giving somebody –or oneself- a reason or incentive to do something				

Control of one's fate 4 3 2 1

- To influence or direct one's destiny

Self-confidence 4 3 2 1

- Assurance in one's own abilities

Altruism 4 3 2 1

- Concern for the welfare of others, as opposed to egoism

Autonomy 4 3 2 1

- Self determination, independence

Ability to "make a difference" 4 3 2 1

- Self explanatory

Name: _____
Date: _____

Fall Post-semester Inventory
Fall 2000

Living Upstream: Learning How to Serve
Our Downstream Neighbors
FRES 1010

1. Is there a difference between service learning and community volunteering? Why or why not?

2. Besides this class, have you ever taken a service learning class before? If so please provide a description of the class.

3. Who will be the recipient of our service learning project?

4. What course-related concepts, issues, or themes do you understand better as a result of our service-learning project? Please check the appropriate response:
   ___ Watershed concept
   ___ Indications of water quality contaminates
   ___ Impact of landuse on water quality
   ___ Opportunities at the community level for citizen involvement in water quality issues
   ___ Service Learning approach to education
   ___ Role of vegetation in protecting water quality
   ___ Non-point vs. Point source pollution
   ___ Impacts of impervious surfaces
   ___ Connection between water quality and biological/aquatic life
   ___ Hydrologic cycle
   ___ Available water sources for Georgians

5. Is the service learning project a valuable component of this seminar? Why or why not?

6. Because of this class, would you say that you are now more likely to volunteer for an environmental organization? Why or why not?

7. What concerns you most about water quality? Why?

8. What is "good water quality"

9. What impacts water quality?

10. Please respond to the following questions regarding our project:
    Answer the following with either: Yes, No, Maybe

a. Do you think that our service project will be useful to the community? _____
Comments?

b. Do you think that your learning is being enhanced through this project? _____
Comments?

c. Have you learned more about the community through our project? _____
Comments?

d. Have you learned more about water quality issues through our project? _____
Comments?

e. Would you be interested in taking another service learning class if the subject appealed to you? _____

Please circle the number that corresponds with how you would rank yourself regarding these concepts at **this time in this class**:

Ranking

	Excellent	Good	Fair	Poor
Team-building	4	3	2	1
• Ability to participate in collaborative activities to address a common goal				
Team work	4	3	2	1
• Collaborative effort by members of a group to achieve a common goal				
Leadership	4	3	2	1
• Capacity or ability to guide				
Reflective Thinking	4	3	2	1
• Careful and thoughtful consideration				
Community Concerns	4	3	2	1
• Understanding concerns and issues applicable to one's community				
Civic Responsibility	4	3	2	1
• Possessing a duty or obligation as a citizen for one's surrounding community				
Self-awareness	4	3	2	1
• Recognition of oneself as an individual entity or personality				
Environmental Concerns	4	3	2	1
• An interest in the state of our environment				
Resourcefulness	4	3	2	1
• Capable of acting effectively or imaginatively, especially in difficult situations				
Problem Solving	4	3	2	1
• The ability to work out a difficult / uncertain question or situation				
Observation	4	3	2	1
• The act of noting something resulting in an inference or judgment that is acquired from or based on observing				
Motivation	4	3	2	1
• The act of giving somebody –or oneself- a reason or incentive to do something				

Control of one's fate 4 3 2 1

- To influence or direct one's destiny

Self-confidence 4 3 2 1

- Assurance in one's own abilities

Altruism 4 3 2 1

- Concern for the welfare of others, as opposed to egoism

Autonomy 4 3 2 1

- Self determination, independence

Ability to "make a difference" 4 3 2 1

- Self explanatory

Name: _____
Date: _____

Spring Post-semester Inventory
Spring 2001

Living Upstream: Learning How to Serve
Our Downstream Neighbors
FRES 1010

1. Pretend you saw a landfill bordering a river in your hometown. What would you do about it? (List three thoughts or actions you might take.)

Which of the above actions seems best to you?

What do you think is the **real** problem in this scenario?

2. What do you feel is your main contribution to our video project?

3. What has been the most difficult part of our class for you?

4. How do you believe our community views you and your work on our video project? As a student? As a friend? As a community member?, etc.

5. What insights have you gained into people and their role in protecting our water resources?

6. During the 2001 legislative session, the Georgia General Assembly was asked to pass a "Water Bill of Rights". Among other things, the bill of rights stated that Georgia's waters shall be "held by the state as a trustee [protector] charged with the duty to manage the waters in the best interest of the public". Business leaders throughout the state fought the "Water Bill of Rights" tooth and nail! Why do you think that is?

7. Please respond to the following questions regarding our project:
Answer the following with either: Yes, No, Maybe

f. Do you think that our service project will be useful to the community? _____
Comments?

g. Do you think that your learning is being enhanced through this project? _____
Comments?

h. Have you learned more about the community through our project? _____
Comments?

i. Have you learned more about water quality issues through our project? _____
Comments?

Please circle the number that corresponds with how you would rank yourself regarding these concepts at **this time in this class**:

Ranking

	Excellent	Good	Fair	Poor
Team-building	4	3	2	1
• Ability to participate in collaborative activities to address a common goal				
Team work	4	3	2	1
• Collaborative effort by members of a group to achieve a common goal				
Leadership	4	3	2	1
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Reflective Thinking	4	3	2	1
• Careful and thoughtful consideration				
Community Concerns	4	3	2	1
• Understanding concerns and issues applicable to one's community				
Civic Responsibility	4	3	2	1
• Possessing a duty or obligation as a citizen for one's surrounding community				
Self-awareness	4	3	2	1
• Recognition of oneself as an individual entity or personality				
Environmental Concerns	4	3	2	1
• An interest in the state of our environment				
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Autonomy 4 3 2 1

- Self determination, independence

Ability to "make a difference" 4 3 2 1

- Self explanatory

APPENDIX D

SAMPLE LECTURE

Sample Lecture
September 5, 2000
Introduction to the 21st century oil → WATER

What is water used for?

Bathing, drinking, a waste removal, dish washing, car washing, industrial coolant, agriculture, 70% of the human body is water, etc.

Now, can you think of some non-human uses of water?

1. Water limits the distribution of plants. EX. The water tupelo tree does best in flooded areas like the swamps of South Georgia
2. Many Animals rely directly and indirectly on water. Many terrestrial animals depend on plants as food. Because of this their distribution is dependent on the distribution of their food source. EX. The red kangaroo in Australia coincides with the 400 mm rainfall contour of the country. It is in this region where arid grasses grow.
3. Photosynthesis- plants take in carbon dioxide and water to produce simple sugars and oxygen
4. Plants and animals maintain their thermal and moisture balance with water. EX. A marathon runner will sweat profusely to reduce his/her body heat. Likewise, plants maintain their leaf temperatures by regulating water loss.
5. More than half of the world's animal and plant species live in water!

As you can tell from this simple brainstorming activity, all living organisms require water! It is a crucial element of today's life as well as historical life. Before we look at present day concerns regarding water quality and quantity, lets go back in time and look water's role in history.

Anasazi Indians

The Anasazi Indians used to live in the Southwest region of the US. This area is often referred to as the 'four corners' and consists of - New Mexico, Arizona, Utah and Colorado. The Anasazis are the ancestors of modern Pueblo Indians now living in New Mexico and Arizona. They settled and farmed the four corners region from 1 AD to 1300 AD.

The Anasazis built and lived in magnificent cliff dwellings and pueblos- which are like apartment styled villages. Physically, they were quite short: 5'1'' to 5'5'' on average. Their infant mortality was high at 33 percent and life expectancy was about 40 years. Babies were held down to cradle boards when born and the dead were buried in a fetal position.

The area's first inhabitants were originally hunters and gatherers. But, in time, agricultural knowledge came north from Mexico. Around 1 AD, inhabitants began dry farming. This method of farming relied on water in the soil from melted snow, summer

rainstorms, and occasional springs. They farmed intensively planting large and small patches of land…basically wherever they could find water.

The Anasazis grew corn, beans, and squash. Archaeologists' suggest that the Anasazis grew 40 bushels of corn per acre! For comparison sake, modern dry farming produces only about 14 bushels per acre. Surplus corn was stored in large storerooms to last through risky years.

As an aside: Corn would be ground on stone slabs. Inevitably, corn would pick up fragments of rock and lead to extreme wear and tear on their teeth.

The Anasazis left quickly without leaving many clues as to their motivation. Many have speculated that there was a massive war…but violence is not overwhelmingly evident in their remnants. One of the most widely held theories is that the drought of the late 13th century caused abandonment.

Research shows that between 600-900 AD the settlements were heavily populated. Some communities were supporting as many as 20,000 people. (This population size is actually equivalent to modern towns found today in the same region once occupied by the Anasazis.) At this time, conditions were favorable for agriculture. In fact, for hundreds of years the first farmers were very successful. Their intricate water collection system, community reservoirs and small dams provided enough water to get through the temporary dry spells. But, around 900 AD, environmental conditions started to change. Frequent droughts and killing frosts made farming unreliable.

Ultimately, the Anasazis may have reached the limit of the natural resources available to them. When crops consistently failed, people moved away or became more dependent on hunting and gathering. Today, the only remnants of the Anasazis include their pueblo housing, pieces of pottery, and rock art.

Now, lets look at our history closer to home and explore the role water played here in Athens.

University of Georgia

Georgia became the first state to charter a state-supported university. In the summer of 1801, a committee of the trustees and the first elected president for the University, Abraham Baldwin, selected a 633 acre hill top site for the university. In one trustee's words:

> "In the midst of the summer (1801) they set out into the forests of the northwest and did not stop until they almost entered the Indian territory. The land was hilly and the streams clear and swift. Here at the last tavern, on the edge of all white habitation, they began the intensive search for the

> inevitable hill from which knowledge should go out to the people. After debating various eminences, they agreed upon a small plateau high above the Oconee River where it swirled down over some rocks near a clump of cedar trees. This spot was known as Cedar Shoals among the few frontiersmen…"

The site was attractive because of its beauty and healthfulness, the presence of good springs of water and the fact that shad ascended the river in "great protection". In addition, the location was far from the evils of town life.

In 1803, Athens had three dwelling houses, three stores, and other buildings. In 1804, the Trustees began to lay out a street plan for Athens. This small community had certain requirements. One of these was clear water. The university was sited in the particular place in part because several springs from beneath the college hill provided abundant water. Students swam and bathed in the Oconee River.

The river had been described as a clear stream flowing over rocks and gravel when it was first encountered by Europeans. Daniel Easley, who sold the land to the Trustees, constructed a grist mill on the river before the university site was chosen. Today, Dial America is located in Easley's old grist mill. By 1865, there were up to 16 mills in Clarke County. Waterpower allowed Athens to be an antebellum industrial center in Georgia.

Today, Athens water resources are largely ignored. The springs that inspired the original trustees have been paved over and students no longer swim or drink the water from the tributaries of the Oconee river.

TRANSITION

By reviewing the role of water from a historical perspective, we can return to our roots and gain an appreciation for how crucial water is and was. Today, water is just as important but we have become disconnected to its role and its overall importance for all of life!

So with that said, lets explore the earth's water cycle and where all of our water resources can be found.

Hydrologic Cycle

*Show diagram of hydrologic cycle

The hydrologic cycle is the endless circulation of water from the atmosphere to the earth and its return to the atmosphere through condensation, precipitation, evaporation, and transpiration. Indeed the water available for living organisms to use today is the same water available to the Anasazis and to the original UGA trustees and students. In fact, the water you use to cook your spaghetti noodles could be the same water that washed a pharaoh's feet 3,000 years ago!

So lets look at each element of the hydrologic cycle. We will look at these individually and out of context but realize that each is part of the continuous cycle of water.

Evaporation occurs when water is heated by the sun. This causes the water molecules to be energized and the attractive forces of water are broken. When this happens, water evaporates and invisible water vapor then rises up into the atmosphere.

Evaporation occurs on both land and water. Water evaporates from the surfaces of leaves. Water also evaporates from lake surfaces. This is actually a major concern and drawback of man made reservoirs. Reservoirs are often built in order to provide sources of drinking water for a community, town, or city. But, water loss due to evaporation from a reservoir surface creates a major deficit of available drinking water. EX. For example, on the Colorado river is littered by a number of dams and reservoirs. Here the evaporation potential of the reservoirs is so large that ONE-THIRD of the river's flow is evaporated i.e. LOST!

Transpiration. Closely linked to evaporation is transpiration. This term applies specifically to plants. It is the process in which plants suck up ground water through their roots and transports water to their leaves. Here at the leaf surface, water evaporates and rises up into the atmosphere.

Plants are able to suck up water from the soil via osmosis. As plants lose water through transpiration, the concentration of water molecules in the cells decrease. So, when water is available, water can move from the soil and into the plant.

Plants can control the amount of water in which they lose via special cells called stomata. Plants close their stomata during the hottest part of the day. Some plants, such as rhododendrons, fold or roll their leaves to conserve water. This process reduces the amount of solar radiation the leaf intercepts.

Condensation. Not shown on your diagram, condensation occurs when water vapor rises and cools in the atmosphere. It eventually condenses and becomes a liquid again or turns into a solid (ice, hail, or snow.) These water particles then collect and form clouds.

Precipitation: Precipitation in the form of rain, snow, and hail comes from clouds. Clouds can become so saturated with water that water begins to fall as rain, snow, or hail, depending on the temperature of the surrounding air.

Runoff: Surface Run-off (or just plain run-off) occurs during heavy rains when the soil is saturated. When this occurs, excess water flows across the surface of the ground.

Runoff is increased when land is devoid of exposed vegetation and soil. For instance, urban areas have a huge problem with high levels of run-off. Paved roads,

buildings, sidewalks, parking lots, and roofs are all examples of **impervious surfaces**. Impervious surfaces essentially block the seepage of water into the soil. When falling precipitation cannot absorb into the land, it results in **huge** influxes of water into nearby streams or rivers. Next time it rains, watch to see where the rain water goes. You will notice that it quickly runs off into a nearby storm drain. In Athens, this storm water run-

off flows into storm drains and then directly into the North and Middle Oconee- the two rivers in the Athens area. Now that you know this, can you tell me what might be some implications of this street run-off? What might we do to remedy these problems?

-combined sewers example

-porous pavement → limit pooling.

Percolation. Some of the precipitation and snow melt can move downwards through the cracks, joints, and pores in soil and rocks until it reaches the water table where it becomes groundwater. This is referred to as percolation or infiltration (which is what your diagram calls it). You can also use the word "percolate" as a verb to explain the downward movement of water.

Once water has percolated through the soil and rocks, its flow is eventually stopped due to an impenetrable layer. Here it accumulates and is referred to as groundwater. Groundwater flows slowly- typically covering distances of several MILLIMETERS to a few METERS each day!

Groundwater is stored in aquifers. There are two types of aquifers- confined and unconfined. An **unconfined aquifer** is one that receives water directly from the surface waters that lie above them. The upper limit of an unconfined aquifer is the **water table**. Eventually, this groundwater will reappear above the ground. This is called discharge. Groundwater may flow into streams, rivers, marshes, lakes, and oceans…or it may discharge in the form of springs and flowing wells. **Confined aquifers** are also referred to as artesian aquifers. This aquifer is a groundwater storage that lies between impermeable layers of rock.

*Show Diagram of groundwater supplies in the US.

Overall, groundwater is considered a non-renewable resource. This is because it has taken hundreds or even thousands of years to accumulate. Aquifers **can** "recharge". Recharge areas are the land from which water percolates to replace groundwater. These recharge areas may be hundreds of miles away. In addition to often removed recharge areas, only a small percentage of water is replaced each year by percolation of precipitation.

Roughly half the population of the United States uses groundwater for drinking. Many large cities including Tucson, Miami, San Antonio, and Memphis depend almost entirely on groundwater for their drinking water. This figure shows that California, southern Arizona, and the high plains area have the most significant groundwater depletion. Can you suggest a reason for why might this be?

Groundwater is also used for industry and agriculture. Roughly 40% of the water used for irrigation in the US comes from groundwater.

*Show diagram of the Olgallala Aquifer.

Now lets look at a case study- the Olgallala Aquifer. The high plains is a highly productive area yielding wheat, corn, cotton, and livestock. To achieve this it requires roughly 30% of all the irrigation water used in the US. Farmers in this region rely heavily on this aquifer. In some areas, farmers are withdrawing water from the Olgalla aquifer at a rate that is 40 times faster than nature replaces it. The depletion of the aquifer has lowered the water table by more than 30 meters (100 feet)! Since Olgallala's water is unevenly dispersed, shallow areas have experienced recent population declines as farms have failed. In other areas, higher pumping costs have made it too expensive to irrigate.

Closer to home, many Georgia residents receive drinking water from the Floridian aquifer. This aquifer is located just below the fall line. It stretches from Columbus to Augusta. Next time we meet, we will take a closer look at this aquifer and the sorts of threats it is currently under.

The Hydrologic cycle is just that…one continual cycle! Precipitation becomes surface water, soil moisture and ground water. Groundwater circulates back to the surface, and from the surface all water returns to the atmosphere through evaporation. It is a cycle that keeps going and going…just like the energizer bunny! Can you guess what the energy/power source of this cycle is? The sun provides the energy source to keep this cycle in motion.

So, one of the major **take home points** of today is that water is continually cycled through out the earth. Water is neither created nor destroyed. It is RECYCLED! The water we have today available for all living organisms to use is the same water available to the Anasazi Indians!

EXTRA TIME QUESTION
*Now that we have looked at nature's way of recycling water, how do humans recycle their water?
- Waste water and drinking water treatment plants
- Collecting greywater

What's available for us to use?

Okay, I have talked about the how water cycles throughout the earth. Based on our discussion so far, what types of water are readily available for humans to use?

Groundwater, river (surface) water, collected precipitation, reservoir water, etc.

Now, can you think of some water resources that are NOT readily available for human consumption?

Glaciers, ocean/salt water, etc

*Show pie chart of available water resources

Although three-fourths of the Earth's surface is covered in water, 97% of that water is seawater which is not readily available for us to use. In fact, only 2.5% of the world's water resources are fresh! And, of this two and a half percent, roughly 2% is locked up in polar ice caps. So, whats left for us to use? **Groundwater** .5% and lake, rivers, soil, moisture, etc .03%. Basically, all living organisms that require freshwater resources, only have a little more than .5% of the world's available water to use! As human population numbers climb, this quantity is becoming a scarce and fought after resource. And, in addition, we are also having to face the fact that we are not the only living organisms that need freshwater.

Keeping in mind all of these facts, you can perhaps understand why water has been referred to as the **oil of the 21st century**!

So, who uses the majority of our water resources?

In the literature, estimates vary on how much water different users actually use. Despite different estimates, one thing is certain, agriculture uses the most available water!

*Show pie chart of water use
This chart shows that roughly 41% of the available freshwater is used in Agriculture. Other accounts state that agriculture uses 68.3%. Industry is generally sited as the second major user and households are sited as the third major user accounting for 10% of the total freshwater useage.

EXTRA TIME QUESTION:
* Can you think of ways in which agriculture could use water more efficiently?
- Drip irrigation measures (ex. UGA campus)
- Use water gauges to access when watering is truly needed
- Plant crops adapted to the environment of which they grow (ex. Rice fields in arid California)

Journal Assignment for September 5th 2000

Did you realize that water is recycled over and over again? Now that you know this, does this cause you to reconsider the ways in which you use water?

APPENDIX E

PROJECT DEVELOPMENT WORK SHEET

FRES 1010 Living Upstream: Learning How to serve Our Downstream Neighbors
Fall 2000
The University of Georgia

Project Title?

Community Need:

1. What community issue or problem will our project address?
2. What results or changes do we anticipate?

Learning:

1. What area(s) of the curriculum will we address with this project?
2. What skills and knowledge will we gain through this service project?

Student Participants:

Students enrolled in FRES 1010 Living Upstream: Learning How To Serve Our Downstream Neighbors

Partner(s):

1. Who will be our partner(s)? (Business, parents, school students, agencies, organizations)
2. What role will each partner play in project development and implementation?

Project Explanation:

1. What will we do?
2. What kind of preparation will we need before doing this project?
3. What will others involved in the project do?
4. What is our projected timeline for the project?

Action-Service Given:

1. What Service will we be providing to the community?

Reflection:

1. How and when will we reflect on our learning?
2. What documentation is needed?

Evaluation:

1. How will we evaluate the effect of our project?

Publicity:

1. How will we publicize our project?

APPENDIX F

ADDITIONAL QUESTIONS FOR ONGOING REFLECTIONS

What have you learned thus far in regards to your community, watersheds, and yourself? What skills have you learned?

Community:
1. What volunteer opportunities are available to you within the Athens community? Do similar opportunities exist elsewhere (your hometown, state, nation)? Do any of these opportunities appear desirable to you?
2. Can you have an impact on your community? Why or why not?
3. Assuming that you will live in Athens for four years, is there any reason why you should become active in a temporary community such as Athens?
4. What impact can community organizations have on environmental issues? Can they even have an impact?
5. What might impact a person's involvement in their community? What impacts your involvement?
6. How do you define community?
7. Do you have obligations to your community?

Watersheds:
1. Why is the concept of watersheds useful? What is a watershed? Do watersheds follow political boundaries?
2. If politicians thought along the lines of "watershed" (as opposed to political term limits and state boundaries), how might our environmental policies change?
3. Is it a challenge for Americans to think of watersheds as an interconnected system? Why or why not?
4. What would it take to cause you to think differently about the ways you use water?
5. Are you worried about future issues of water scarcity? Why or why not?
6. Is there anything you can do to address water quality issues? Why or why not?
7. Will our video on water quality be useful to others? Why or why not?
8. Have you applied your knowledge on water issues to events/conversations/experiences outside of our class? If so, describe these experiences.

Yourself:
1. Do you like the service learning approach to education? Specifically, what do you like about service learning and what do your dislike? Does this approach fulfill your learning needs? Would you take another service learning course?
2. Do you feel confident in your abilities to conduct research? Why or why not?
3. Do you enjoy working in groups? Why or why not?
4. Does this class motivate you? Why or why not?
5. Do you feel comfortable in our class? Why or why not?
6. How do you define the cliché "making a difference"? Does this cliché apply to you and your work in this class?

Other skills:
1. Have you enhanced your verbal/speaking skills?
2. Have you learned how to use a new piece of equipment? (Internet, fax machine, copier, etc)
3. Have you discovered new areas around Athens that could help you with your research?
4. Do you feel like you "know your way around Athens" better?
5. Have you discovered a new area of interest?