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Sustainability and the future: a case study on environmental perspectives of the future generation of scientists

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SUSTAINABILITY AND THE FUTURE: A CASE STUDY ON ENVIRONMENTAL PERSPECTIVES OF THE FUTURE GENERATION OF SCIENTISTS

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ABSTRACT

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In the natural sciences, countless studies have sought to quantify the environmental impacts of varying anthropogenic activities and have predicted and modeled future scenarios for the natural world under the siege of human forces. Faith for the study of and action to ameliorate environmental impacts is often put in the hands of scientists. However, little research has been conducted to look at the attitudes and perceptions future scientists have towards the environment with regard to anthropogenic environmental impacts, sustainability, and the future.

Therefore, the purpose of this qualitative case study was to take an intensive look at one such group of future scientists, the Sputnik Institute (pseudonym) 2010 scholars. Specific questions addressed through the research included: What do students with an aptitude for the sciences perceive as our greatest environmental threats and solutions to said problems? What emotional impacts are associated with internalizing thoughts on environmental issues? How do thoughts on environmental issues impact perceptions of the future? What role does spirituality/religious beliefs and family play in perceptions of environmental issues? What are participant's major sources of information regarding environmental issues? When interviewed post-program, have participants gained further

knowledge regarding Sustainability and what would they wish to cover if given the option to take a course on Sustainability?

Multiple approaches were employed to answer the outlined questions including, but not limited to: pre and post open ended questions, multiple semi-structured interviews, post program interviews, participant reflexivity, critical self reflexivity, and participant observations. Findings of the study indicate that indeed, the future generation of scientists are concerned for both current and future anthropogenic environmental impacts as well as the feasibility of achieving sustainability, though they may currently lack the educational tools necessary to make a switch to a sustainable paradigm a reality.

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"The only way to predict the future is to have power to shape the future"
-Eric Hoffer, American Philosopher

INTRODUCTION

Statement of Problem

In a time full of environmental uncertainty, many stakeholders in both the present and future of society and the environment hold immense interest in understanding the attitudes individuals hold towards the environment. Through the use of various attitudinal surveys and assessments, researchers have quantified the environmental attitudes of many subsets of society (Dunlap, 2008; Castro, 2006; Wray-Lake, Flanagan, & Osgood, 2010; Johnson & Scicchitano, 2000) for the purpose of predicting the future outcome of environmental sympathy and action.

In order to ensure a switch to a sustainable paradigm and future, policy makers and educators alike must know where society stands in terms of environmental knowledge, attitudes, and behavior. Several sentiments are becoming apparent. Although the modern environmental movement, along with environmental education, has been steadily increasing since its beginnings in the United States in the 1970s, an increase in pro environmental sentiment or behavior has not been readily apparent in society (Wray-Lake et al, 2010). Also apparent is the increasing polarization of environmental issues in representations by politics and media alike.

Therefore, among one of the major decisions, we as citizens of the Earth have is to decide how we will tread forward with regards to environmental issues that threaten our sustainability as a species and society. In order to predict how the future of the sustainability and environmental movement will solidify, it is important to examine the environmental perceptions of the current generations to determine where they stand. However, little has been done to examine the environmental perceptions of future generations, specifically adolescents. In addition, little research (Jurin, 2006) has been conducted in understanding what sort of impact, if any, internalizing such perceptions of environmental issues has on emotions as well as outlooks on one's future career, incorporation of environmental issues into future career, and the alignment of personal future outlooks verses environmental outlooks.

Globally, a call for an increase in the human dimensions of conservation biology has been made (Jacobsen & McDuff, 1998). Recognition of the central role humans' play in the beginning, middle, and end of conservation issues is critical if we intend to move towards a sustainable paradigm. However, conservation biologists are generally trained in only the ecological sciences or natural resource management and have little knowledge of policy processes, social sciences, or communications (Jacobsen, 1990). Therefore, in order to disseminate critical knowledge to the general population regarding the human dimensions of biology and sustainability, conservation biologists need to develop a holistic understanding of the human dimensions aspect.

Within the natural sciences, disciplines such as Conservation Biology and Disturbance Ecology have developed for the purpose of studying the effects of anthropogenic activities on the biosphere and have predicted and modeled future

scenarios for the natural world under the siege of human forces. Through the onset of the modern environmental movement, scientists such as Rachel Carson and E.O. Wilson have led the charge to bringing notice of anthropogenic impacts to the natural world (Sale, 1993). Therefore, faith for the study of and action to ameliorate environmental impacts is often put in the hands of scientists. However, little research has been conducted to look at the attitudes and perceptions that future scientists have towards the environment with regard to anthropogenic environmental impacts, sustainability, and the future.

Statement of Purpose

The purpose of this qualitative case study was to take an exploratory approach to assessing and describing the environmental perspectives of a sample of the future generation of scientists. Specifically, I examined the attitudes and perceptions that adolescents with an aptitude for the sciences hold towards environmental issues, sustainability and the future. In this case study, I took an intensive and holistic look at one such group of adolescents with aspirations to become future scientists, the Sputnik Institute (SI) (pseudonym) 2010 Scholars. By understanding the worldviews and perceptions held by future scientists, we may be better equipped to predict the future of society and whether a switch to a sustainable paradigm will be feasible. Within the purpose of the research, the human dimensions aspect of conservation biology is addressed within the paradigm of sustainability, as both share the implicit goals to protect longevity and harmony in both human species and all other forms of life. Therefore, the

purpose of the research is to also enhance the human dimensions aspect of conservation biology.

Research Questions

The primary research questions addressed by the present study include:

Q1: What do students with an aptitude for the sciences perceive as our greatest environmental threats and solutions to said problems?

> a. Are differences apparent in perceived environmental threats and solutions between immigrant students versus native students?

Q2: What emotional impacts are associated with internalizing thoughts on environmental issues?

Q3: What do students with an aptitude for the sciences perceive as personal and societal barriers to achieving sustainability?

Q4: How do thoughts on environmental issues impact perceptions of both personal and global futures?

Q5: What role does spirituality/religious beliefs and family influence play in perceptions of environmental issues?

Q6: What are students' major sources of information regarding environmental issues?

Q7: If interviewed post-program, have participants' perceptions, knowledge, or outlooks on sustainability or the future changed?

> a. What do students with an introduction to sustainability feel are the most important means to communicate sustainability to others?

Importance of Study

Humans have and will continue to shape the natural environment and impact how all other species can exist on Earth. With the current human population at nearly 7 billion and continuing to grow exponentially, humans are going to continue to impact the natural

environment. It has been noted that with the exception of humans, no terrestrial large mammal species have populations that are currently larger than 30 million (Fowler, 2005).

Human overpopulation is a direct cause of biodiversity loss (Fowler, 2005). As a result of human overpopulation, species richness across all biomes that humans inhabit is decreasing. McKee, Sciulli, Fooce, & Waite (2003) noted that abating human population growth is a necessary step in the epic attempt to conserve biodiversity on the global scale. Humans are dramatically changing the landscape of the Earth, and consequently, changing other species abilities to inhabit it.

To remedy, stabilizing the human population is important because of the wealth of factors involved, including biosphere degradation and factors contributing to an increasing human population (Fowler, 2005). Fowler (2005) concluded in his study of human population growth that population is two to four orders of magnitude larger than is optimally sustainable when compared with the populations of other mammalian species of similar body size. He concluded that as a result, "human overpopulation is a significant contributor to health problems for humans, other species, and ecosystems" (Fowler, 2005).

I emphasize human overpopulation as an example of the intersectionality of biological issues with social, environmental, and economical realms. If humans are to switch to a sustainable paradigm, root problems such as human overpopulation need to be understood from a variety of lenses. Therefore, root problems such as human overpopulation transcend one discipline and are in the realm of issues that need to be addressed through an interdisciplinary lens.

In order to actively address root problems such as human overpopulation, current and future generations need to be environmentally literate, aware, and provided the tools of empowerment in order to enact a switch to a sustainable paradigm. Therefore, in order for individuals to assess and understand such topics of fundamental importance, critical thinking must be nurtured and harnessed at a young age. Further, educational intervention strategies must target the intersectionality that comprises a complex issue such as human overpopulation.

In order to re-design policy and the educational system, it is of vital importance to take inventory of where individuals stand in terms of environmental worldviews, attitudes, and behaviors. Therefore, the present study serves as a bridge between describing the underpinnings of the current state of the present generation regarding their environmental worldviews so that successful intervention strategies can be designed and implemented to address deficiencies uncovered. By providing the tools for students to become environmentally literate critical thinkers, we may better ensure that current and future generations can understand and manage complex issues involved in the present and future state of the environment.

Theoretical Framework

The basis of this research is guided by a constructivist approach. The foundation of constructivism is that humans do not find or discover knowledge so much as construct or make it (Crotty, 2007). This concept relates to the proposed research in that students receive information from a variety of inputs (school, family, friends, media, etc.) regarding issues relating to the environment and sustainability, but it is up to them to

construct what that information means to them. This idea of individuals constructing their own reality based off of information received (either during the study or prior to it) will serve as a general theoretical guide to understanding and interpreting the results of the data collected.

Multiple theories exist that seek to provide a basis for why individuals undertake particular attitudes, beliefs, and values and put them into behavioral practice. In order to better understand actions taken, it is important to form a basis into how participants construct knowledge and perspectives on topics revolving around environmental issues, sustainability, and the future. Using knowledge and perceptions as predicators, it is important to predict how not only knowledge and perspectives are formed, but how knowledge and perceptions may contribute to present and future behaviors undertaken by participants. In order to gain greater perspective into how behaviors are undertaken, two models revolving around predicting behavior further guide the research. For the purpose of the research, The Theory of Reasoned Action and The Hines Model of Responsible Environmental Behavior were chosen as the most appropriate theory and model to guide my theoretical framework.

Theory of Reasoned Action and Planned Behavior.

Born out of the field of Social Psychology, The Theory of Reasoned Action (TRA) and the more recently developed Theory of Planned Behavior (Ajzen, 2005) posits that the ultimate determinants of any behavior are the behavioral beliefs concerning its consequences and normative beliefs concerning the prescriptions of others (Ajzen & Fishbein, 1980). The Theory of Reasoned Action (Figure 1) assumes that individuals

premeditate on actions taken before a behavior is displayed (or not). Therefore, according to the theory, an individual's behavioral intention is influenced by the individual's attitude towards the behavior and social pressures to perform or not perform the behavior. However, a third and critical component of the TRA posits that despite intentions to carry out a specific behavior, not all behaviors are under voluntary control, and are thus subjected to situational factors.

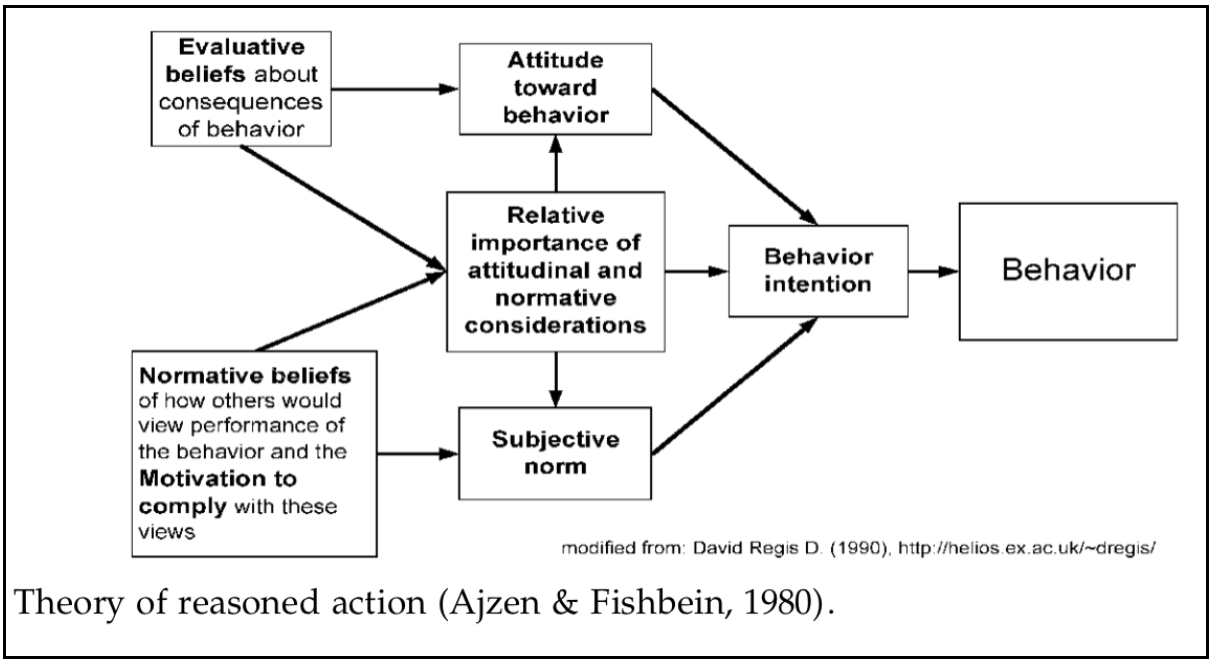

Figure 1: Adapted from Kollmuss & Agyeman (2002)

The strength of the TRA is to better predict an individual's intent in order to determine whether a corresponding behavior is undertaken. The following example illustrates how the TRA works: If you intend to reduce your waste stream through recycling the majority of your waste, there is a high chance you will undertake recycling your waste as part of your daily routine. The undertaking of a lifestyle focused on reducing your waste stream is more or less socially acceptable, and thus social pressures

are nil. However, situational factors that rest outside of social pressures and behavioral intention may get in the way of actually implementing the said behavior. In the case of recycling, perhaps an individual does not live or work in an area that accommodates for recycling. Therefore, the outward display of a behavior is the result of the interworking of a variety of layers that either enhance or inhibit the fruition of a behavior.

The Theory of Reasoned Action relates to the research study in that students receive information pertaining to environmental issues, sustainability, and the future and then demonstrate behavior according to the their attitudes. Students' attitudes and behaviors are displayed based off of the importance of these topics/issues in their lives and the relative societal pressure to adhere to or distance themselves from that knowledge. Further implementation of a behavior can be enhanced or hindered by situational factors such as lack of resources, time, and/or information. It was therefore assumed that students entering the program will carry with them their own pre-conceived attitudes on topics relating to environmental issues, sustainability, and the future, and have displayed behaviors accordingly. The Theory of Reasoned Action was thus utilized in order to better predict and understand the varying facets influencing behavior that participants described and portrayed historically in their lives.

The Hines Model of Responsible Environmental Behavior.

Developed in 1986, The Hines Model of Responsible Environmental Behavior is based upon the Theories of Planned Behavior and Reasoned Action (Hines, Hungerford, & Tomera, 1986). The Hines Model of Responsible Environmental Behavior (Figure 2) is the product of a meta-analysis that identified variables that appear to be most

influential in motivating individuals to undertake responsible environmental behavior (Kasapoglu & Ecevit, 2002).

Hines et al (1986) identified six key variables associated with an individual displaying responsible environmental behavior: knowledge of issues, knowledge of action strategies, locus of control, attitudes, verbal commitment, and individual sense of responsibility (as cited in Kollmus & Agyeman, 2002). As with many topics, in order for an individual to enact responsible environmental behavior, they must first be familiar on some level with environmental problems and their causes.

Once an individual has knowledge of environmental issues, they must know how to enact change or otherwise impact the mitigation or prevention of an environmental problem. However, the ability for an individual to enact change in order to mitigate an environmental problem is restricted to their locus of control. In other words, the locus of control "represents an individual's perception of whether he or she has the ability to bring about change through his or her behavior" (Kollmus & Agyeman, 2002).

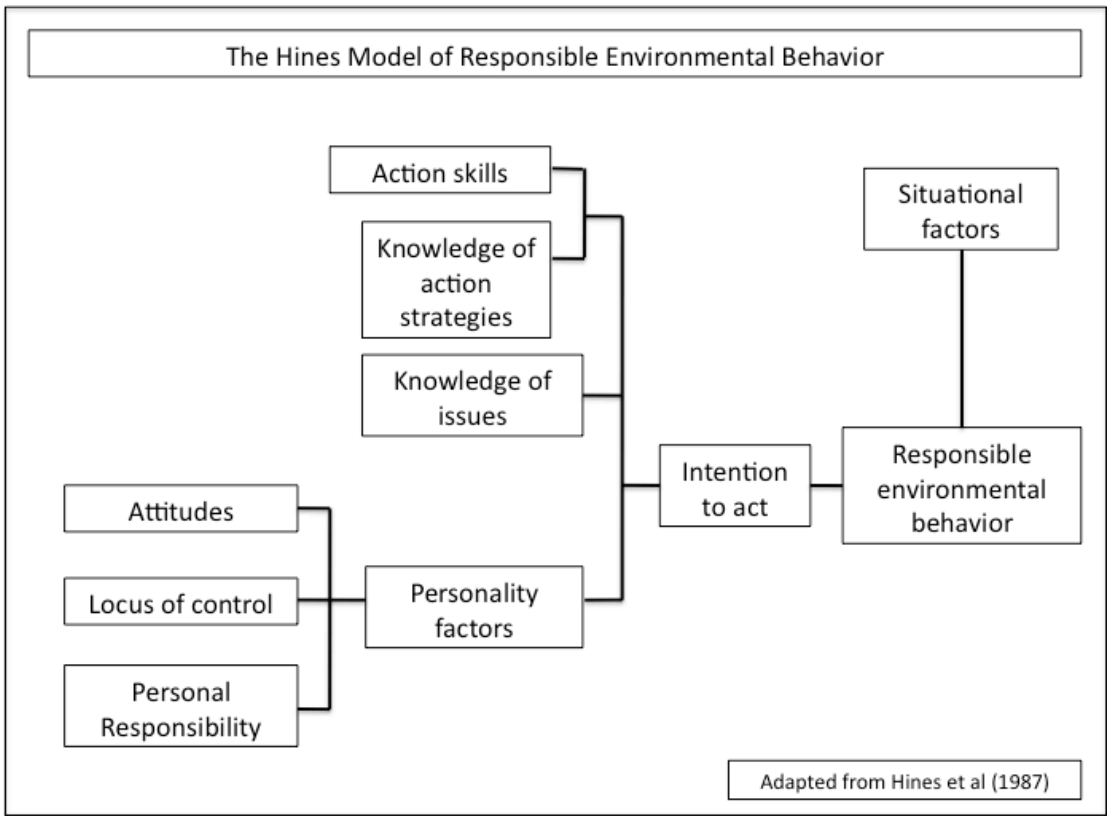

Figure 2: Adapted from Hines et al (1986)

Similar to knowledge needed to enact responsible environmental behavior, so too are attitudes found to be important. In general, individuals who possess stronger pro environmental attitudes are more likely to demonstrate pro environmental behavior. However, the relation between attitudes and actions does not always correlate (Kollmus & Agyeman, 2002). An individual who identifies both a sense of responsibility and communicates conviction to take action towards mitigating an environmental issue is also indicative of an individual's likelihood to display pro environmental behavior. Though similar to the Theories of Reasoned Action and Planned Behavior, the Hines Model of Responsible Environmental Behavior accounts for other factors (situational factors) that influence pro environmental behavior including but not limited to: economic constraints,

social pressures, and opportunities to choose different actions (Kollmus & Agyeman, 2002).

The Hines Model of Responsible Environmental Behavior will serve as a basis to interpreting results obtained from the study. In particular, research questions that address varying components of the model included:

1. What level of knowledge do participants hold regarding definitions of sustainability, environmental issues, and solutions to said environmental issues?
2. What personal responsibility do participants feel towards preventing or mitigating environmental issues?
3. What verbal commitments do participants make regarding addressing environmental issues, both in their current lives and in their future careers?

Theoretical Perspective

Through personally reflecting on my concerns for sustainability and the future, my philosophical assumptions align most closely to that of Ecofeminism. Ecofeminism is a philosophical vantage point, which blends together aspects of feminism and environmentalism. In particular, Ecofeminists draw parallels between patriarchal oppression of females and abuse of the environment, and rejects a hierarchal model of life in favor of an interconnected web (Deegan & Podeschi, 2001). Therefore, I approached the research study from the view of an Ecofeminist, and interpreted the data obtained accordingly.

Assumptions

Due to the exploratory nature of the research, I assumed the participants' provided me with responses to all questions reflected their honest knowledge, opinions, and attitudes. Therefore, I assumed that all responses did not reflect what participants perceived of me wanting to hear from them, but what they truly felt.

Definitions

Attitudes: The degree to which an individual demonstrates a like or dislike for a given item. Attitudes are organized and placed within social beliefs that predispose individuals to feel, perceive, and behave accordingly to some object, group, or person (Zimbardo & Ebbesen, 1970; Kerlinger, 1984).

Beliefs: Information regarding people, places, objects, and issues that an individual collects and expresses using propositions such as: I know, I believe, and I think. Beliefs can rest within factual knowledge or be opinion based and are socially reinforced. (Fox-Parrish, 2006; Kerlinger, 1984).

Emotion: The resulting product from the interaction between the mind, internal influences, and external influences. "Emotion involves physiological arousal, expressive behaviors, and conscious experience" (Myers, 2004).

Environmental Education: "Possessing the capability of meeting environmental challenges through promoting awareness and knowledge on various environmental issues" (Tuncer, Ertepinar, Tekkaya, & Sungur, 2005).

Environmental issues: Overarching term used to describe negative anthropogenic impacts on the biophysical environment.

Environmentally Responsible Behavior (ERB) or Pro Environmental Behavior (PEB): "When an individual or group aims to do what is right to protect the environment in general daily practice" (Cottrell, 2003). In other words, an individual's or group's "approach to seeking information, making decisions, and valuing a stewardship ethic (Monroe, 2003).

Extracurricular program: "A non-classroom-based educational program that includes, but is not restricted to, concepts that are taught in school" (Ruiz-Mallen, Barraza, Bodenhorn, & Reyes-Garcia, 2009).

Pro Environment: A generalistic term used to describe a sentiment held by an individual who is actively concerned for past, present, and future environmental issues.

Sustainability: Sustainability is considered an elusive term to define and is dependent upon the context in which it is applied and whether the use of the term is based on an ecological, social, or economic perspective (Shearman, 1990). For the context of the proposed research, sustainability can be defined from an ecological perspective as the continued productivity and functioning of ecosystems (Brown, Hanson, Liverman, & Merideth, 1987).

Value: "a desirable transsituational goal varying in importance, which serves as a guiding principle in the life of a person or other social entity" (Schwartz, 1992). After a value is realized, it is placed in hierarchical importance in relation to other perceived values (Rokeach, 1973). Values therefore assimilate to form value systems, which function within the workings of central belief systems (Jurin & Fortner, 2002).

CHAPTER II

LITERATURE REVIEW

In this chapter I will examine both foundational and novel literature pertaining to how perceptions of sustainability and environmental issues are constructed. Great emphasis will be placed upon assessing both the historical and current state of research on environmental attitudes and behavior, as both are significant in shaping environmental worldviews. Subsequent sections will explore other facets of the research questions including: young people's visions of the future, role of religious beliefs on environmental perceptions, impact of environmental education intervention, human dimensions of conservation biology, and use of the New Ecological Paradigm Survey in environmental attitudinal research.

Environmental Attitudes and Behavior

It is commonly assumed that attitudes and behavior align. However, as outlined by The Hines Model of Responsible Environmental Behavior (1986), attitude represents one cog within the workings of a displayed behavior. Pro environmental behavior, or environmentally responsible behavior, can be displayed in a variety of ways and contexts, which include: public environmental activism, public non-activist political behavior, private environmentalism, and reflecting behaviors to which an individual belongs (Stern,

2000). Out of the possibilities, private environmentalism is perhaps the most widely adopted, as it revolves around consumer purchases and energy with the intent of protecting the environment (Mobley, Vagias, and DeWard, 2010).

Several models have been outlined (Hungerford & Volk, 1990; Stern & Dietz, 1994; Stern, 2000) that seek to determine the factors contributing to environmentally responsible behavior. The multilevel model of environmental behavior (Hungerford & Volk, 1990) outlines sequential variables that impact environmental behavior. The first in sequence is environmental sensitivity and knowledge of ecology that enhance decision making while undertaking an action (Mobley et al, 2010). The second sequential variable is one of ownership, in which a sense of accountability is developed in one regarding a given environmental issue. The third sequential step involves providing an individual with tools of empowerment so that they can "make a difference" regarding a given environmental issue (Mobley et al, 2010).

A study conducted by Mobley et al (2010) sought to assess the premise that individuals who are knowledgeable and concerned for the environment actively engage in environmentally responsible behavior. Previous researchers (Zeleny, Chua, & Aldrich, 2000; Xiao and McCright, 2007; Hines et al., 1986; and Dietz, Stern, & Guagnano, 1998) have provided evidence of the role of knowledge and awareness of environmental issues as precursors to environmental attitudes and environmentally responsible behavior.

Based on the premises of studies conducted prior, Mobley et al (2010) predicted that knowledge and environmental sensitivity serve as critical prerequisites for environmentally responsible behavior. Mobley et al (2010) hypothesized that 1) sociodemographic variables serve as precursors to environmentally responsible behavior

and 2) the reading of environmental literature increases an individual's level of concern for the environment. Results of the study indicated that indeed, exposure to environmental literatures serves as a powerful predictor of Environmentally responsible behavior that was independent of background demographic characteristics (Mobley et al, 2010).

A study conducted by Tuncer et al (2005) assessed Turkish students' attitudes towards the environment with respect to school type and gender. The researchers adapted questionnaires based off of earlier work done by Herrera's (1992) questionnaire of Environmental Beliefs, which is an attitudinal assessment used to determine the saliency of environmental attitudes.

The researchers found that 48.8% of students attending both public and private schools believed that the ultimate solution to environmental problems is to change our lifestyles. The researchers found that a difference was exhibited in the attitudes and beliefs held by students with differing school types and gender, with private school students and female students demonstrating greater support of conservation of the environment. However, Tuncer et al (2005) found that overall, support for conservation of the environment was demonstrated. The results of this study demonstrate that students are aware that environmental issues are caused in large part due to human lifestyles, yet they lack the knowledge of how to enact change in their lifestyles to reduce or mitigate environmental impacts.

A qualitative study conducted by Connell, Fien, Lee, Sykes, & Yencken (1999) assessed the environmental attitudes held by youth in two Australian cities. The participants interviewed were asked to identify their priorities in life and describe their

concerns, feelings and ideas on the causes and possible solutions to environmental problems. The participants felt that the future of the world can be changed if people can change their attitudes and lifestyles. However, students also felt the future is going to get worse (ecologically) and they had little power to change the outcome. The researchers concluded that greater attention should be invested in implementing environmental action competency in environmental education. Environmental action competency can be defined as utilizing knowledge gained and putting it into action. An example of knowledge that could be gained would be learning about overconsumption and choosing to live mindfully.

The research conducted by Connell et al (1999) suggests that an assessment of environmental attitudes and perceptions of students generally allows for several key observations. One observation is that students are aware on some level of environmental issues occurring in the present and predicted in the future. However, students often feel helpless and unable to change the future. In addition, students can often recognize that human behavior and lifestyles are at the root of environmental problems. In order to positively impact these perceptions, environmental education intervention strategies must be designed that allow students to understand how seemingly abstract environmental concepts and issues relate to their lives and how they can positively impact the outcome of the future through how they live and the actions they take on or careers they choose in the future. Though unfortunately, environmental education intervention strategies are not widely accessible to public schools across the United States.

Young People's Visions of the Future

A growing body of research (Wheeler & Bijur, 2000; Hicks, 2001) has demonstrated that many young people hold bleak perspectives on the future. A paper composed by Hicks (2001) examined research on how young people conceptualize the future and provided guidance on how to better reform citizenship education with the hopes of addressing these perspectives. Hicks (2001) posits that both young people's and adult's perceptions of the future are based largely off of oversimplified stereotypes acquired through the process of socialization. Hicks (2001) argued that the four most common images of the future present in Western Society include: business as usual, technological fix, edge of disaster, and sustainable society.

A business as usual image of the future is a view held by individuals who expect that the future will be very similar, if not the same, as today (Hicks, 2001). In other words, the world will go on similar to how it does today with few perceptible changes. One who holds the technological fix image of the future believes that hardships and problems indeed exist currently and will in the future, though the answer to all problems encountered lay in the continued growth of science and technology (Hicks, 2001). An edge of disaster view of the future is held by individuals who fear that society is on the verge of collapse from one or any combination of environmental, economic, or social catastrophe. An individual who holds a view of a future sustainable society accepts that the future requires a fundamental change of direction, but believes the end product invoked through change will be a just and sustainable society (Hicks, 2001).

The first three images (business as usual, technological fix, and edge of disaster) are the most common in Western society (Hicks, 2001). Through viewing the future through narrow perspectives, imagination to think beyond becomes limited and thus a creative range of possible futures are not realized (Hutchinson, 1996). Therefore, if young people and adults are locked in to envisioning the future from such narrow perspectives, it is understandable how bleak outlooks for the future arise.

A study conducted by Hutchinson (1996) surveyed Australian secondary students to investigate the nature of their probable and preferred futures. Overall, results obtained from the study indicate that the secondary students held bleak and pessimistic outlooks of the future (Hutchinson, 1996). The results of Hutchinson's (1996) study as well as several others (Oscarsson, 1996; Hicks & Holden, 1995; Toffler, 1974) indicate that often times, students hold overall optimistic images of their personal futures, yet tend to be pessimistic of global futures. Therefore, contradictory perspectives of the future arise when people imagine both their personal and global futures.

Role of Religious Beliefs on Environmental Perceptions

According to recent surveys (Putnam & Campbell, 2010), 83% of the United States population identifies as belonging to a religious denomination. Out of the 83% of self-identified religious citizens, 76% identify as Christian (Kosmin & Keysar, 2009). Multiple studies (Schultz, Zeleny, & Dalrymple, 2000; Greeley, 1993; White, 1967) have sought to determine to what extent religious beliefs impact environmental attitudes and behavior. In order to gain perspective in to the underlying ideas that shape participants environmental perceptions, it is important to understand what role, if any, religious

beliefs or spirituality plays on individuals thoughts on the present and future with regards to environmental issues.

A study conducted by Peterson & Liu (2008) in the Teton Valley of Idaho and Wyoming sought to assess the relationship between religious beliefs and environmental worldviews while controlling for nonreligious regional culture and political affiliation. Participants were assessed for environmental worldviews using both structured interviews and administration of the New Ecological Paradigm (NEP) survey. Results were consistent with previous studies which found that on a scale, people associated with Mormonism demonstrate the least environmental worldviews, people associated with other Christian and Catholic groups demonstrate moderate environmental worldviews, and people not religiously affiliated tend to demonstrate the most pro environmental worldviews (Peterson & Liu, 2008). The researchers also found that alignment with a religion was a more important shaper in environmental worldviews than religiosity (degree of religious activity). The researchers concluded that education is less important than deep-seated cultural values associated with religious identification (Peterson & Liu, 2008).

A study conducted by Wolkomir, Futreal, Woodrum, and Hoban (1997) conflicts with the notion of biblical literalism and religious saliency inhibiting environmental concern. Wolkomir et al (1997) found that neither biblical literalism nor religious saliency show any negative impact on environmental behavior. Further, religious saliency actually demonstrated a positive effect on environmental concern. The findings of the study allude to the movement of Judeo-Christian beliefs moving from a dominion belief to that of stewardship for the environment. The trend of 'greening churches', this study,

and others points to the potential for a restorative relationship between religion and the environment. Environmental concern and environmental behavior are therefore correlated, but are not identical (Wolkomir et al, 1997).

Impact of Environmental Education Intervention

A challenge encountered in education is to determine how to best aid students in making meaningful connections to the material presented. As mentioned in the theoretical framework, I am taking a constructivist stance, thus assuming that students construct the meaning of topics encountered individually. Some research in the area of environmental education has focused on the efficacy of teaching topics pertaining to Ecology and Environmental awareness in an extra-curricular setting where students can view the material in a different light than what is presented in school.

A study conducted by Ruiz-Mallen et al (2009) demonstrated that students who participated in an extra-curricular environmental education program increased their ecological knowledge and environmental awareness. The researchers determined quality of the program by measuring the participants' knowledge after attending the program. In a study conducted by Bradley, Waliczek, & Zajicek (1999), students that participated in a 10-day environmental science course demonstrated a 22% increase in environmental knowledge upon completion of the course.

In addition, other research has assessed the level of academic achievement demonstrated in students that have been exposed to environmental education. A study conducted by Lieberman and Hoody (1998) compared academic achievement of students involved in environmental education programs versus students that were not. The

researchers found that students involved in environmental education programs performed better academically in the areas of reading, writing and math when compared to students not involved in an environmental education program. Therefore, inclusion of environmental education may aid in increased academic performance across the curriculum.

The above-mentioned studies highlight some of the roles environmental education programs play. To expand more on some of the ideas mentioned, environmental education does not solely impact the increase in knowledge of environmental issues or biological issues. Environmental education can also positively impact the learning outcomes in other fields seemingly unrelated such as reading, writing and mathematics. This can likely be attributed to the holistic nature of environmental education and the avenues for critical thinking which many of the topics explore. Based off of the findings of the previously mentioned research studies, I predict that participants that enter the program with previous classroom experience in environmental education will demonstrate greater pro environmental sentiment.

Human Dimensions of Conservation Biology

In order for humans to develop a holistic awareness of sustainability, we must be able to develop an ecological consciousness. The human dimensions aspect of conservation biology directly addresses this disconnect, and allows bridges to be made across the natural sciences to the social sciences responsible for effectively disseminating information. A multitude of educational programs ranging from elementary age all the

way to graduate level are beginning to recognize the critical importance of better incorporation of the human dimensions lens into conservation biology.

A study conducted by Trewhella, Rodriguez-Clark, Corp, Entwistle, Garrett, Granet, Lengel, Raboude, Reason, & Sewall (2005) assessed the efficacy of incorporating environmental education into biological conservation programs for critically endangered fruit bats from the Western Indian Ocean Islands. In particular, the program sought to make connections between humans and the endangered bat species through linking human needs to the ecosystems services provided by the bats (Trewhella et al, 2005). The fruit bat conservation programs demonstrated important outcomes and established the foundation for future conservation actions (Trewhella et al, 2005).

A study conducted by Jacobsen, McDuff, & Monroe (2007) investigated the role of the arts in making an emotional connection to people learning about nature conservation issues. The researchers found that through the use of visual arts, conservationists and artists can help to forge a connection between people and nature. Through developing a connection to nature, people become more likely to develop pro environmental sentiment, and thus become more interested in the environment. The researchers concluded that by focusing on forging emotional connections to nature, conservation education could improve scientific and environmental literacy in a way that a formal presentation of scientific information cannot (Jacobsen et al, 2007).

Multiple studies (Inouye & Brewer, 2003; Hayes, 2009; Clark, 2001) have recognized the importance of incorporating interdisciplinary curriculum to undergraduate and graduate biology programs for the purpose of producing environmentally literate biologists. A study by Clark (2001) conducted a critical assessment of the ability for

current university curricula to adequately prepare biology students to meet the needs of professions involving real-life conservation problems. In particular, biology curricula often focus narrowly on the training of scientific and technological proficiency at the expense of integrative policy-oriented problem solving skills (Clark, 2001). To remedy, Clark (2001) cites three changes needed to biology curricula for university students: "(1) an understanding of how the policy-making system works and how human value interactions constitute the core of professional work, (2) mastery of skills in critical thinking and development of an interdisciplinary, "procedural rationality" for analyzing problems and evaluating potential solutions, and (3) development of influence and responsibility within policy systems."

New Environmental Paradigm (NEP) Survey

Originally developed in 1978, the NEP Survey has become the most widely used measure of environmental concern (Dunlap, 2008). Since its development, the NEP Survey has been utilized globally in hundreds of studies. Therefore, due to the wide validation of the NEP Survey as serving as a reliable tool to measure environmental attitudes, it was chosen as the most appropriate means to gain a general perspective on the environmental attitudes held by participants at the start of the program.

It is important to know about the history and prevalence of the NEP Survey in order to understand why the NEP Survey was chosen as the initial test of environmental concern of participants. Born out of the prominent Dominant Social Paradigm (DSP), which categorized how individuals interpret meanings of the external world (Pirages & Ehrlich, 1974), the NEP sought to focus specifically on categorizing how individuals

interpret meanings of the external world with regards to the environment. In particular, the NEP focused on three major threads: "existence of ecological limits to growth, importance of maintaining the balance of nature, and rejection of the anthropocentric notion that nature exists primarily for human use" (Dunlap, 2008).

The NEP Survey has continued to evolve through the decades since its birth in order to maintain relevancy both in language and environmental issues. In 1990, Dunlap developed a major revision to the NEP Survey to instead measure the degree of endorsement of an ecological worldview. Specifically, the New Ecological Paradigm (again NEP) Survey was designed to address the weaknesses of the original NEP Survey and to determine how much modern industrial society is exempt from ecological constraints (Dunlap, 2008). In contrast to its use in quantitative work, the NEP Survey was utilized as a supporting document (Merriam, 1998) in the present study to both develop an understanding of participants environmental attitudes coming into the program and also to serve as a source of triangulation.

CHAPTER III

"Not everything that can be counted counts, and not everything that counts can be counted." -Albert Einstein

METHODOLOGY

Qualitative Inquiry

Due to the exploratory nature of the research, a primarily qualitative approach was chosen as the most appropriate means to interpret the environmental perspectives of this understudied population of post adolescents with an aptitude for the sciences. Qualitative research can be defined as an "umbrella concept covering several forms of inquiry that help us understand and explain the meaning of social phenomena with as little disruption of the natural setting as possible" (Merriam, 1998). In other words, qualitative inquiry is more concerned with the 'why' questions associated with research and relies on interpreting the experiences of the participants through the lens of the researcher.

Traditionally, research conducted within the natural sciences has relied on empirical investigations guided by a positivist approach. Positivism can be defined as an epistemological perspective that places value on objective and observable phenomena that can be validated through rigorous use of the scientific method. Positivists consider knowledge to be stable, observable, and measurable (Merriam, 1998). Therefore, positivism serves as the foundation for quantitative research and the scientific method.

In contrast to quantitative research, qualitative researchers operate under the assumption that reality is a social construct made up of the culmination of individual interactions of one within their social world (Merriam, 1998). Therefore, qualitative researchers seek to interpret the meanings constructed by individuals to make sense of their world. Knowledge gained through qualitative inquiry is thus fluid, subjective, and individualistic. The goal then of qualitative researchers is to gain insight into the phenomenon of interest from the participant's perspective. This research fits well within the confines of qualitative research in that I am interested in understanding the participant's perspective (the future generation of scientists) and perceptions of anthropogenic environmental impacts, sustainability, and the future.

Case Study

Several strategies to conduct qualitative research exist and can be utilized independently or in tandem to carry out research goals. Case study is a type of qualitative research that takes an intensive look at a single unit or bounded system (Merriam, 1998). Case study research can be defined as an "empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 1994).

This research fits within the confines of case study research. In particular, I sought to provide an intensive and holistic description of a single bounded unit, namely, the Sputnik Institute (SI) 2010 scholars. The phenomenon, being the environmental perceptions of the SI 2010 scholars, can be considered intrinsically bounded due to the finiteness of both the length of time and quantity of participants involved.

Participants

As previously mentioned, the participants in this qualitative case study were the Sputnik Institute scholars of 2010. The Sputnik Institute is housed within a mid-sized Rocky Mountain University. In compliance with Institutional Review Board (IRB) policy, all students attending the program as well as their legal guardians were asked to sign consent and assent forms (Appendices C-E) in order to participate in the research study. The entire cohort of 2010 SI scholars agreed to participate in the research study. The participant population consisted of 28 high school students, who were at the time entering their junior and senior years of high school. The participants included 13 males and 15 females.

Participants in the study hailed from varying demographic and geographic backgrounds. In total, 12 participants (43%) came to the program from suburban surroundings, 11 participants (39%) came to the program from rural surroundings, and 5 participants (18%) came to the program from urban surroundings. Out of the 28 participants, 4 immigrated to the United States from their home countries within: Africa, India, and China.

Inspired by the launch of Sputnik, in 1959, SI became the first state-focused science institute to provide outreach and enrichment to students demonstrating a strong aptitude for the sciences (Ball, 2009). SI is a pre-college summer program held at a mid-sized Rocky Mountain University that seeks to enhance scientific aspiration and achievement of Colorado's high school juniors and seniors who possess a strong interest

and aptitude for science (Ball, 2009). SI strives to balance rural and urban participation, maintain gender equity and recruit students from underrepresented groups (Ball, 2009).

SI is an intensive, six-week program that mirrors college in that it places students in dormitories, requires them to attend rigorous classes and complete in-depth research in one of several science fields. Students are selected for this program based on their academic performance in their respective high schools, test scores, responses to essay questions and recommendations from their high school faculty and staff. Potential students must demonstrate a strong aptitude in science and the potential to excel in a demanding research environment among other top students.

Exposed to curricula encompassing current frontiers of science, students in SI are expected to assume both the roles of college students and budding research scientists. They complete coursework and laboratory activities in engineering, chemistry, biochemistry, biology, earth, physical and space science. As part of SI's curricula, students attend seminars by professional research scientists, participate in industrial visitations and take a variety of educational field trips. Outdoor education is also heavily emphasized, requiring students to actively engage in demonstrative learning activities in environmental education while on team-building, field-based instructional camping trips to Rocky Mountain National Park and Swift Ponds. Most importantly, the students conduct collegiate level research in their primary scientific field of interest under the supervision and guidance of university professors and graduate students. In doing so, SI students develop a literature review, research paper, website, conference-grade scientific poster and a professional PowerPoint presentation on their research conducted.

During the summer of 2010, SI offered three unique courses, representing some of the fields on the frontiers of science. In Technology, SI students learned about the evolution of 0 and 1. That is to say, they learned of the roots of the earliest forms of technological communication (such as the binary system) and how it has evolved to what we think of technology today. A major component of the technology class was for students to master programs such as Dreamweaver and successfully develop their own professional websites, detailing their research conducted. In Health, students took a holistic look at human health. Topics covered were variable, but covered such topics as individualized diet analysis, exercise and fitness assessments and studying the effects of exercise on cardio and respiratory function.

In Ecology, Conservation Biology and Sustainability, students explored the interconnectedness of these three fields in order to understand complex environmental issues from a critical perspective. Students were charged to take responsibility for their learning in the form of critical reflections on scientific literature, laboratory exercises, hands on activities, debates on current environmental issues, discussions and presentations. During the class, students were tasked to research, design, and develop an effective presentation to teach their peers about a specific topic pertaining to sustainability.

Research Settings

The primary site for data collection during the research study was a mid-sized Rocky Mountain University. Specifically, the pre and post program open-ended questions and the pre and post New Ecological Paradigm Survey were issued during class time in

the Science Hall. Interviews were conducted almost exclusively in the participants' dormitory hall during free time (generally before or after dinner time). Observations were taken primarily after conducting interviews. In addition, participants were prompted to reflect in their field journals during a trip to Rocky Mountain National Park.

Data Collection

On the first day of scheduled class of the program, all of the participants participated in an assessment of their knowledge and attitudes regarding sustainability and environmental issues. Knowledge and attitudes of the participants were assessed using both open-ended pre-program questions and a modified version of the New Environmental Paradigm (NEP) Survey (Appendices D & E). The NEP survey is composed of a 5-point likert scale survey in which participants self identified as strongly agreeing or strongly disagreeing with statements pertaining to the environment. The results of the survey were scored (0-5), which produced a number demonstrating participants' pro environmental sentiment (Appendix E). The higher the number, the greater pro environmental sentiment was demonstrated and vice versa. The NEP survey served as a supporting document (Merriam, 1998) in the research in order to gain an understanding of the diversity in environmental attitudes present in the group. Therefore, the survey was not used in the data analysis.

On the last day of scheduled class of the program, all of the participants participated in an assessment of their knowledge and attitudes regarding sustainability and environmental issues. Knowledge and attitudes were again assessed using both open-ended post program questions and an identical version of the modified version of the

NEP Survey issued at the start of the program (Appendices D + E). However, one participant did not complete the post program NEP survey for unknown reasons. To gain a better understanding of the participants' motivations and aspirations for their desired future professions, participants were asked during the program to complete an assignment detailing their future career goals (Appendix G).

Due to time constraints, purposeful sampling was used when selecting and conducting open-ended, semi-structured interviews (Merriam, 1998). The selection process for interviews was based off of convenience (participants willing and able to be interviewed) and responses to both the open-ended pre-program questions and New Ecological Paradigm issued at the start of the program. In total, 18 participants were interviewed in person during the program while the remainder of participants was asked via e-mail to provide feedback on the interview questions (Appendix F) immediately following the program. Interviews conducted in person were variable in time but ranged between 15 and 35 minutes. Out of the remaining participants that were not interviewed during the program in person, six participants were interviewed over e-mail immediately following the program.

During the program, participants were asked to provide reflections prompted by quotes and readings. The reflections served as both assignments for the class (Ecology, Conservation Biology, and Sustainability) and as supporting documents (Merriam, 1998) to better understand the unique perspectives of the participants. During the field trip to Rocky Mountain National Park, participants were asked to provide a reflection on a quote outlined in the Moraine Park Museum regarding future visions of Rocky Mountain National Park with regards to development (Appendix I). Participants were also asked to

write a reflection on a scientific paper discussing the role of fire in human evolution and ecology (Pausas & Keeley, 2009). Finally, participants were asked to read the story *Thinking Like a Mountain* by Aldo Leopold (Leopold, 1949) and write a reflection relating the story to the issue of elk overpopulation in Rocky Mountain National Park (Appendix I).

Approximately four months post program, an addendum to my IRB approval (Appendices C) was developed, reviewed, and accepted to re-contact participants for the purpose of conducting post program interviews. All participants were contacted via e-mail addresses provided during the program and asked to respond to post-program interview questions (Appendix H). In total, 11 of the 28 participants responded to the e-mail with their input on the post-program interview questions.

Data Analysis

Campbell and Stanley (1963) outlined successful pre/post survey assessment design and threats to validity. The main threats to internal validity include small sample size relative to questions posed, short time duration between administration of pre and post survey, and low geographic diversity (Campbell and Stanley, 1963). Because the research conducted rested solidly on qualitative methodology, the NEP Survey was issued in order to gain a greater understanding of the participants' environmental attitudes coming in to the program. Responses to the survey were tabulated to determine the overall scores of participants in order to gain multiple perspectives on their environmental attitudes. Therefore, no quantitative statistics were run on data obtained from the NEP Survey.

In qualitative research, the researcher serves as the primary instrument for data analysis (Merriam, 1998). In order to be the primary instrument of data analysis, data collection and analysis occur simultaneously. The nature of qualitative research allows for evolution as the researcher learns more about the research. Upon completion of the interviews, I wrote a brief summary of the interview, including observations such as: general comfort, how the interview went and noted quotes of interest. I then transcribed the interviews at the soonest convenience (Creswell, 2007). In total, over 60 hours of research time was allocated towards accurately transcribing interviews from audio files into word files. After transcription, I coded the transcripts (Merriam, 1998). Coding can be defined as making notes, comments, observation, and queries in the margins of a transcript for the purpose of noting data that strikes you as interesting and potentially important or relevant to addressing the research questions (Merriam, 1998).

Upon coding, a thematic analysis was conducted to determine which common themes arose from the interviews (Creswell, 2007). Furthermore, I conducted a thematic analysis both within interviews and between interviews, as unique perspectives arose from both comparisons. I then compared the interviews to the research questions to determine if they were adequately addressed. Through conducting multiple interviews, a point, called saturation, is reached in which developing categories are no longer augmented through interviews. It became apparent around the 10^{th} interview that saturation was being reached in that no new themes became apparent that were shared across all of the interviews (Creswell, 2007).

Researcher Personal Stance

A researchers personal stance or perspective serves to elucidate a researchers assumption, worldview, and theoretical orientation (Merriam, 1998). In other words, it allows for the reader to better understand the perspective and approach a researcher takes and is thus able to interpret accordingly. A researcher's personal stance is further critical because in qualitative research, the researcher serves as the primary instrument of data collection and analysis (Merriam, 1998).

Throughout my life, I have always been curious about humankind's interaction with the natural world. Some thoughts that swam through my head as a child were: what happens to items and waste when we are finished with them? How do we endlessly take resources out of the Earth and seas? What are the consequences? Though unfortunately, many of these thoughts remained below the surface prior to a pivotal event in my life. During Winter Break of my sophomore year of college, I watched the documentary *An Inconvenient Truth* with my family and then boyfriend (and now husband). Something about the documentary re-awakened all of these interests and concerns I had harbored and drove me to learn more about the environment and sustainability. The following semester, I enrolled in Introduction to Environmental Studies. It was in this class (and through undertaking a Minor in Environmental Studies) that I became aware of and passionate for sustainability.

Prior to this defining moment, I had planned to complete my degree in Biomedical Science and continue on to medical school, to follow in the footsteps of my father and grandfather. Although I have obtained my pre-requisites for Medical school and have complete confidence in my abilities to become a medical doctor, I have instead

chosen to follow a passion for sustainability that cannot be ignored. After much introspection and growth as an individual, I have realized that education is the reason that I have pursued an interest in sustainability and thus plan for a future career in Sustainability Education.

Since undertaking a minor in Environmental Studies during my undergraduate career, I have had significant life and learning experiences in Sustainability. The classes I took during my undergraduate career ranged from a history of the American environmental movement to conservation of natural resources to environmental politics. Through taking classes on Sustainability, I was driven to take action and not just be a passive learner. I became the President of my university's environmental club, and together, we took on a multitude of projects to promote sustainability on campus and in the community. During my time as President, I was asked to become the campus coordinator for a national environmental campaign, Power Vote. Through the efforts of the club, we got over 700 students to commit to voting for candidates that supported renewable energy.

After obtaining my Undergraduate degree, I accepted a job (alongside my husband) to serve as both the trip directors and Sierra Club Environmental Educators for YMCA Camp Shady Brook. During our time as Sierra Club Environmental Educators, we conducted environmental education for over 70 youth while maintaining a 50,000-dollar Sierra Club/Armed Services Grant. I also had the opportunity to implement environmental education in an informal setting while guiding youth on action-oriented outdoor trips throughout Colorado.

One year in to my graduate studies, I accepted the position as an instructor for the Sputnik Institute. As an alumnus of SI (2004 scholar), I understand the vital role the program plays in nurturing a love for science. I designed my course to focus on the intersectionality of ecology, conservation biology, and sustainability. Through teaching for SI, I had the opportunity to provide learning opportunities for sustainability both in and outside the classroom. It was my goal as an educator to provide the SI students of 2010 with the tools necessary to understand and effectively communicate complex issues and solutions our civilization faces and for them to be aware of the critical role they can play as future scientists in terms of sustainability.

Through conducting research with SI, I was provided a unique opportunity to serve multiple roles: participant, researcher, mentor, and friend. The goal of a researcher is to be value neutral and an observer. I did my best to honor my role as a neutral researcher and observer, but allowed the participants to know me as I participated in the program. Therefore, my enthusiasm for sustainability was readily apparent and may have been noticeable to the participants. Because of this, participants may have been influenced by my views of sustainability and answered accordingly. However, I stated at multiple points throughout the program and research process that I wanted to gain their honest and personal feedback on posted questions, activities, and assignments. Based off of the data collected, I feel confident that participants did indeed provide me their honest and personal feedback on their perspectives of sustainability and the future.

When personally reflecting on what sustainability means to me, I often visualize the root problems inhibiting a switch to a sustainable future and thus taught according to my perceptions (Figure 3). Further, my background as a biologist and an SI alumnus

(2004) allowed me an opportunity to relate to the scientifically minded participants through discussing sustainability from the vantage point of ecological systems and conservation biology. However, my vantage point as a scientist did indeed limit my approach to sustainability, as I taught from primarily a scientific perspective and not from an economic or social justice lens.

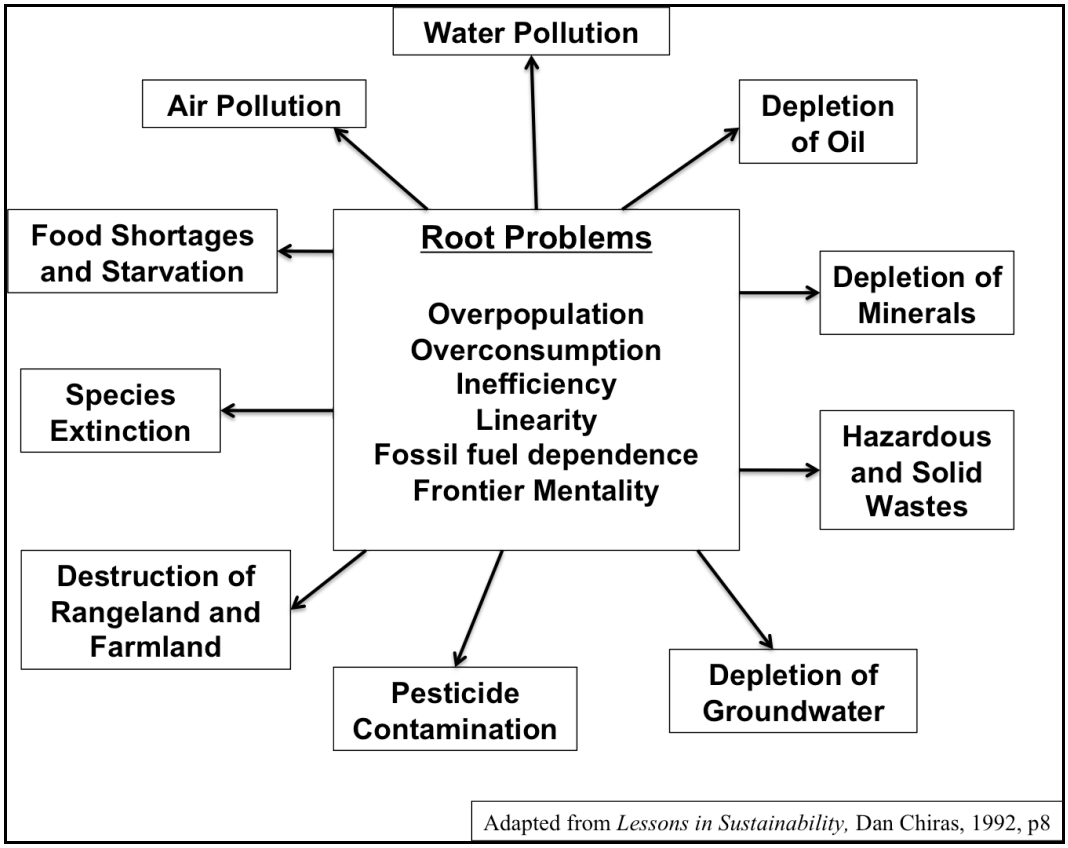

Figure 3: Davidson perspective on Sustainability

Trustworthiness Procedures

In both quantitative and qualitative research, it is critical to establish rigor and confidence in data obtained. In quantitative research, common terms used to describe our confidence in results obtained include validity and reliability. Common terms used to describe our confidence in results obtained in qualitative research include trustworthiness

and confirmability. Trustworthiness can be defined as the quality of an investigation and its findings that make it noteworthy to an audience (Schwandt, 2007). To increase the trustworthiness of a study, credibility, transferability, dependability, and confirmability are tools utilized.

Triangulation is a procedure utilized to strengthen the trustworthiness of a study. Triangulation serves as a means of checking the integrity of the inferences one draws and relies upon the use of multiple data sources, multiple investigators, multiple theoretical perspectives, and multiple methods (Schwandt, 2007). Figure 4 demonstrates the procedures I took to triangulate, and thus increase the trustworthiness of the study.

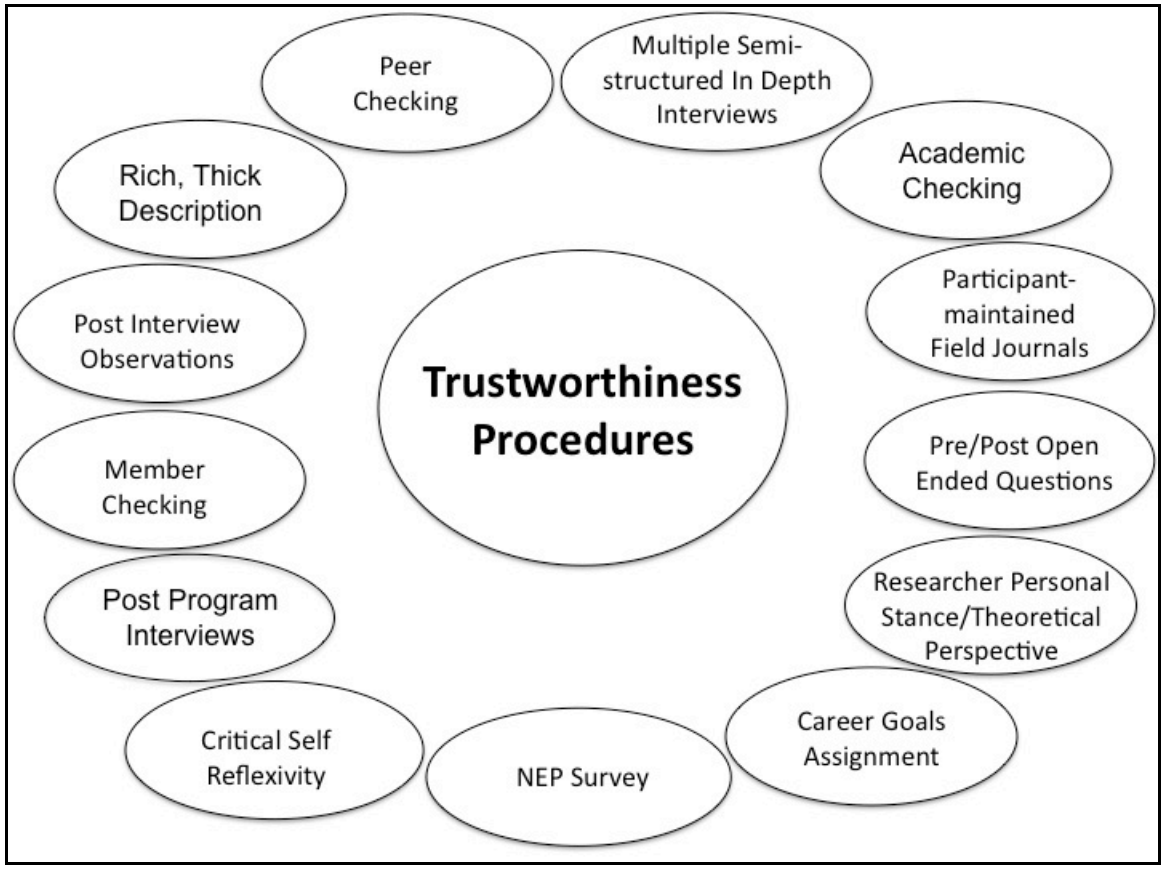

Figure 4: Trustworthiness procedures for the study

As outlined in Figure 4, multiple semi-structured in depth interviews, field journals, pre/post open ended questions, researcher personal stance, career goals assignment, the New Ecological paradigm survey, post interview observations, and post program interviews served as multiple sources for data collection. Once data is collected from multiple sources, further procedures can be done to check the integrity of the data obtained. Procedures used to further improve the trustworthiness of the data obtained included critical self-reflexivity, member checking, rich/thick description, peer checking, and academic checking.

Critical self-reflexivity allows for the researcher to critically inspect the entire research process by stating one's biases, theoretical predispositions, and perspectives throughout. Reflexivity was practiced through maintaining a journal on my research experiences. In it, I discussed the challenges encountered in the research process and the general evolution of the study. Also, participants were asked to practice guided reflexivity through maintaining field journals. In their journals, participants reflected on exercises ranging from fire ecology to the future of Rocky Mountain National Park.

Member checking is a method used to improve the accuracy, credibility, and transferability of a study and involves the distribution of transcribed interviews to participants for the purpose of them to confirm the accuracy of the work. Upon completion of the transcription of the interview, a copy of the transcript was sent to the participant and I asked them to read it over to ensure that they were accurately represented. Out of the 24 interviews conducted during the program (or immediately following via e-mail), roughly half of the participants complied and all confirmed that they felt they were accurately represented by my transcription.

Peer checking is a procedure used by qualitative researchers in order to gain an "outside" opinion on the accuracy of the themes that arose from thematic analysis. Peer checking involves sharing research conducted with knowledgeable colleagues for the purpose of assessing the dependability of results obtained (Schwandt, 2007). In order to determine whether the themes that arose from my thematic analysis were accurate, a peer check was conducted with both a fellow graduate student and previous graduate student that are both qualitative researchers and were familiar with my research. In addition, academic checking was conducted with an expert in qualitative research that is also familiar with my research study.

CHAPTER IV

FINDINGS AND DISCUSSION

In the following chapter, I will systematically explain the findings of the research study, as well as a discussion following each section. The chapter was organized into the following sections: results and discussion of pre/post open ended questions, results and discussion of thematic analysis arising from multiple in depth, semi-structured interviews, and results and discussion of post program interviews. The participants NEP Survey results, reflections, and career goal assignments (Appendices E, G, & I) were used as supporting documents (Merriam, 1998) and were discussed at points within the results of the thematic analysis to increase the strength of the results obtained.

Pre/Post Open Ended Questions

On the first day of scheduled class, participants were asked to respond to several open-ended questions (Appendices D). Questions that were posed to participants at the start of the program as well as the end of the program included: What is sustainability? What are major global issues humanity faces? What are solutions to major global issues? The following tables (1-6) demonstrate some of the representative responses received.

Results

Table 1

Pre Program: What is Sustainability? (Actual student responses)

Capacity to maintain a certain state
Ability to live long enough to reproduce and have their offspring survive
Using resources wisely
Efficient use of limited resources for longest use possible
Study of the environment
Maintain something for an on going amount of time
Ability to maintain existence
Teaching how to hold back from things…sort of like conservation
A balance reached between the development of mankind and the preservation of ecosystems that will be able to be maintained

Table 2

Post Program: What is Sustainability?

A new way of thinking…involves ecology and economics
Practice of conserving, reusing, and recycling resources
Method of activity and living that is cyclical rather than linear in the hope of drawing less on the environment
Change in the mindset of humans that changes the way in which we live
Ideal that mankind and nature will reach some balance that is able to be maintained indefinitely
Using resources at a rate slower than the rate at which Earth can replenish
Taking only what you need and living a toned back lifestyle
Way of life where you make choices to help the Environment
Producing, learning, [and] living in a way so that our children, and children's children, will have the same resources and the same quality of life that we enjoy today
To live simple
Approach to social and economic development and global security

Discussion

Attempting to determine how participants perceived sustainability was a major overarching focus of the research, which encompassed several of the research questions. In order to determine how participants perceived sustainability, I asked them to define sustainability pre program and post program in order to determine 1) what their initial notions of sustainability were and 2) in what ways (if any) their definitions changed throughout attending the program.

A disparity between responses is demonstrated between pre program responses (Table 1) and post program responses (Table 2) regarding a definition of sustainability. When asked pre program to define sustainability, many participants described the concept of enduring or maintaining into the long-term future. Some participants spoke specifically of the endurance of humans, while others mentioned the maintenance of ecosystems or life. I inferred from responses received that most participants addressed the definition of sustainability from the root of the word, sustain.

In contrast, definitions of sustainability post program (Table 2) demonstrated a different focus. In particular, many post program responses tended to discuss how sustainability is practiced, thus shifting the focus away from the root word sustain. Many participants discussed sustainability as being a psychological or behavioral ideal, which requires a new way of thinking about the environment and our actions. Specific examples of sustainability mentioned by participants included living more simply and changing linear production systems to that of cyclical systems.

Results

Table 3

Pre Program: What are major global issues humanity faces?

Gulf Oil Spill	Climate Change
Water scarcity	Human Overpopulation
Disease Transmission	Overconsumption of oil and gas
Loss of Biodiversity	Overfishing
Overconsumption	Pollution
Wastefulness	Over-reliance on technology
Depletion of resources	Poverty

Table 4

Post Program: What are major global issues humanity faces?

Loss of Biodiversity	Overpopulation
Wastefulness	Lack of education/ Lack of awareness
Human behavior	Climate Change
Lacking understanding of root causes of problems	Water Scarcity
Not wanting to change lifestyle	Overconsumption/ Depletion of resources
Limited research on sustainability	Pollution
	Disease Transmission

Discussion

As outlined by the first research question, I was interested in gaining perspective into what students with an aptitude for the sciences perceive as our greatest environmental threats and global issues. Therefore, I posed the question pre program and post program to participants asking them what they perceived as the major global issues humanity faces.

Tables 3 and 4 demonstrate much overlap in participants responses pre and post program. Some of the most popular pre program responses included climate change, pollution, and human overpopulation. Similar to the pre program responses, participants again noted anthropogenic impacts on the natural environment such as climate change, pollution, and human overpopulation in their post program responses. Though notably, in post program responses, participants described varying facets and shortcomings of human behavior as major global issues. Many of the responses addressed a disparity in education of humans causing environmental impacts, and focused less on the actual impacts to the natural environment (such as climate change).

Results

Table 5

Pre Program: What are solutions to major global issues?

Start using nuclear power	Holocaust
Use preventative measures instead of useless antibiotics	Nuclear War
Produce biodegradable products	Invade another planet
Use eco-friendly fuels	Child limit
Penalties or fines for pollution	Increased research in renewable energy
Developed countries need to help Developing countries	Use environmentally-friendly products
Providing birth control to decrease world population	Car pool
Liberation of women	Ride a bike
Set up more national parks	Reduce our consumption
	Increase energy efficiency
	Reduce human expansion and development
	Plant trees

Table 6

Post Program: What are solutions to major global issues?

Increase awareness Preservation and restoration of natural surroundings Increased research in renewable energy Make our lives better and more resourceful Green Building "little things" Recycling Using environmentally-friendly products Work and live as a community Education Provide contraceptives and family planning services	Change our attitudes towards the environment Redesign the American Dream Develop and efficient public transportation system Change production systems Make change instantly gratifying Nuke major cities/Blow up the world Reduce overconsumption through decreasing government subsidies Limit water use Limit automobile usage Government offered free sterilization Practice what we preach – practice personal sustainability

Discussion

Responses received in tables 5 and 6 aid in answering the second part of my first research question, which asks what do students with an aptitude for the sciences perceive as solutions to major global issues. Overlap in answers was again evident when asked pre and post program with several notable differences. Among the most common responses received pre program included switching to and investing more research and money into alternative energy technology, consuming environmentally-friendly products such as organic foods, and limiting reliance on automobiles through carpooling, bicycling, and walking.

Again, post program responses demonstrated overlap with pre program responses, though with a greater focus on changing human behavior through the spreading of awareness and education. Something else notable mentioned both pre and post program regarding solutions to major global issues alluded to resolving problems through violence such as nuclear war or holocaust. I cannot guess that participants were joking with these violent responses, and thus assume that they held stark views of how to absolve major global issues.

Through reading the pre/post program responses, education seems to play a major difference between responses. Several explanations may account for this disparity in results seen pre program and post program. As mentioned previously, participants took a course during the program that was specifically focused on the intersection of ecology, conservation biology, and sustainability. As part of class responsibilities, participants were tasked to research, develop, and present on a topic pertaining to sustainability to their peers. Through taking the class and completing the subsequent assignment on sustainability, students may have expanded their knowledge on sustainability and thus constructed different meanings of sustainability, global issues, and solutions to global issues.

Another source of influence may have included a seminar held on sustainability by a University Professor. In the talk, the speaker focused on addressing root problems versus symptomatic problems and the role of human behavior. Other potential sources of influence included the participants' mentored research projects, educational field trips, and personal interactions with other participants of the program. Sources of information regarding sustainability and environmental issues are discussed in greater depth in a

theme that arose from multiple, semi-structured, in depth interviews: Sources of Information.

Pre Program and Post Program NEP Survey

As previously stated, the NEP survey was issued pre program and post program to serve as a supporting document (Merriam, 1998) to the research. The results of the NEP survey were tabulated (Appendix E) and used as a source of insight into the environmental attitudes of participants coming in to the program. Based off of the diversity of NEP scores and responses to open-ended questions, I asked participants to be interviewed. Again, the NEP scores were not used as a quantitative assessment due to threats to validity (Campbell & Stanley, 1963) and lack of generalizability. However, I note that changes were apparent when comparing pre program scores to post program scores (Appendix E). Notably, some participants demonstrated greater pro environmental sentiment while others demonstrated less pro environmental sentiment. Reasons behind these changes in environmental sentiment were not further explored.

Thematic Analysis of Multiple Semi-Structured, In-Depth Interviews

Through thematic analysis, seven major themes arose. These themes all relate back to my original research question, which sought to explore the participants perceptions of sustainability and the future. The themes that arose tie together major areas covered in the interviewing process as well as research questions. The seven themes include: (1) what can be done, (2) what prevents us from acting, (3) responsibility for the

future, (4) emotional impacts and visions of the future, (5) sources of information, (6) international students perspective, and (7) closing thoughts from interviews. A discussion follows each theme to interpret the results obtained.

What Can Be Done?

What can be done personally?

Through interviews, all participants were asked questions regarding both their current actions taken towards addressing environmental issues and actions that they should take but are not currently. Furthermore, participants were asked to describe what types of actions could be taken as a society to minimize environmental problems. Although most participants extrapolated environmental issues to be beyond what they had listed initially on the pre program open-ended questions (Appendix D), some chose to address the questions through the perspective of perhaps one or two environmental issues. For example, some students that discussed global climate change as our most pressing environmental issue answered questions through the lens of actions they *could* take to prevent or reduce global climate change.

When discussing what actions participants take to address what they perceived as environmental issues, many either prefaced or followed up their thoughts with phrases such as “doing the little things” or “the simple kind of things.” While discussing what she does currently to prevent environmental issues, Maria described “just simple things. You don’t have to change the world doing something huge.”

Another favorable response regarding what participants currently do to prevent or reduce environmental issues was to recycle. Below, a quote by Jerome detailing one of

the ways in which he is acting to minimize the impacts of environmental issues through recycling:

> I work at a coffee shop in my hometown, and I just convinced [the manager] to start using number two plastic cups, which are recyclable. And I have to do it because she is too busy, but I recycle all of the [plastic cups] that we use.

Along with discussing the merits of recycling, some participants, like Jiao, shared their skepticism or distrust of recycling. Jiao described her skepticism of recycling stemming from observations and preconceived notions from her stepfather, who told her that despite having recycling available in their neighborhood, all recyclable goods are later put in the dumpster. Jiao later expressed her confusion over what happens to commingle recyclables once it is taken. "When we recycle, we put everything like plastic and cans and things like that together. How can they separate them? If you want to recycle, they are two different things."

Other actions participants noted that they currently take or could take to prevent or reduce environmental issues included: using energy efficient appliances, limiting water use, limiting use of electricity, drive less, ride a bike, using reusable bags when shopping, limiting use of disposable materials, compost food scraps, plant vegetable gardens, utilize public transportation, limit usage of toxic substances such as fertilizers and pesticides, monitoring what is poured down the drain, picking up trash, support environmentally responsible companies/products, reducing consumption, limit food waste, reducing greenhouse emissions, and 'going green'.

What can be done in society?

When asked what can be done in society to prevent or reduce environmental issues, participants had varying responses to what they considered to be actions they could take personally. Education of the public and spreading awareness regarding environmental issues were popular responses. Again, Maria explains how education is key in minimizing environmental impacts in our society and how environmental issues should be integrated into our educational system:

> …gradual integration of these issues into curriculum…starting at a young age, and then in middle school, increasing them. Because when you are younger, you can't understand to the full extent of your actions. But as you age, you begin to see the big picture in a sense…at the high school level, it would be most effective, but if people don't have the previous exposure, people might not hold as much weight to that as they would if they were exposed at an early age, and then later on in depth when they are older.

Another participant, Heidi, discussed the concept of "voting with your pocket, or with your money" as a means for society to act to minimize environmental issues. Heidi illustrated her thoughts through discussing the documentary *Who Killed the Electric Car*, which describes how an electric car model was developed and produced, then quickly removed from the market for a variety of proposed reasons. Heidi felt that "if people had known about it and were able to buy those electric cars, I think that is one thing that would be different right now."

Some participants, like Edward, discussed the concept of introducing financial penalties in society for living "un-environmentally friendly." He discussed that doing so would "force people to think before they act, for it is financially in their best interest to do so." He feels that this would "initially cause a large negative response from the mass public", though eventually, the penalties would "cause productive debate amongst

everyone, and eventually the general mindset towards these topics will slowly but surely be altered towards a vision of sustainability."

Other actions that participants noted which society could take to prevent or reduce environmental issues included: creating a mass transit system that runs nationally, increasing efficiency of agricultural equipment, education of women to reduce birth rates, impose water restrictions on the public, modernizing the American Dream to minimize overconsumption, decreasing counter-productivity in government, and starting community projects.

Who is responsible?

When participants were asked who they feel should be responsible for fixing environmental issues, the overwhelming majority responded that everyone is responsible. One participant, Megan, said "everyone has an impact on the environment; doesn't matter how big or small, everyone effects it in some way. Everyone is a part of it. It is everyone's mess." Many participants shared similar sentiment to Megan, such as Robert, who felt as though we cannot expect the government to be responsible, but rather "us as a people can't just go along living like we are living." Though Maria goes further in explaining the disproportionate responsibility of the United States over other societies:

> We have the responsibility to the rest of the world because we don't make up that large of population when you put it in perspective, but we use so much of our natural resources.

A small group of participants interviewed expressed the sentiment that the responsibility of environmental issues should fall on specific groups or individuals. One participant, Brittany, feels as though "our government is becoming more and more

socialistic by the second, so I think they should be responsible. They already regulate what a lot of people do, so they might as well regulate something that will help the entire world." Yet another student, Chris, felt as though people who should be responsible for fixing environmental issues is "whoever is interested in them." Chris went on to say that "as long as there is communication between those people, it will work itself out."

Discussion

A portion of research question one was addressed through the theme what can be done by asking participants what can be done (personally or in society) to prevent or reduce environmental problems. Doing the "little things" was a common response by participants when asked what they can do personally to prevent or reduce environmental issues. Many of the actions noted by participants are indicative of symbolic environmental behavior (Jurin, 2002). In other words, the actions they identify that they can do personally are what they have perceived as environmentally responsible behavior. However, when discussing the little things they can do to prevent or minimize environmental issues, they never discussed how the little things actually accomplish this. I interpreted from the responses obtained from participants that they understand symbolically what environmentally responsible behavior looks like, though did not verbalize the connections between how the behaviors actually addressed the environmental issues they noted.

In contrast, when asked to discuss what society can do to prevent or mitigate environmental issues, participants readily noted innovations in education, re-designing national infrastructure, voting for environmentally responsible behavior, or penalizing

against un-environmentally responsible behavior. Again, participants did not integrate their ideas for how society can prevent or mitigate environmental issues into the actual issues caused. In order words, they conceived of what would be responsible behavior for society to take on, though did not make connections to the actual issues in a way that they will be directly addressed.

Participants constructed that a given behavior is environmentally beneficial, but could not verbalize why or how it would mitigate issues. This could be indicative of one or both of the following: participants are unable to make the connections between behavior and solution because of their lack of educational and experiential background or the concept of a given behavior addressing a given environmental issue is too abstract and there is indeed not a logical connection to be made. In addition, it is of interest to note that while participants discussed the importance of society becoming more aware of and educated on environmental issues, none of the participants discussed their *personal* needs for greater awareness or education regarding what they can do to prevent or mitigate environmental issues. This may allude to participants' inability to take responsibility for augmenting their education and awareness of actions to prevent or reduce environmental issues.

It is interesting to highlight again that the majority of participants asked feel that everyone is responsible when it comes to preventing or mitigating environmental issues. It is clear that participants felt as though everyone in society has a stake in addressing environmental issues because everyone contributes to environmental issues. Many participants addressed the question of who should be responsible by focusing on citizens of their country, the United States. Though some, like Maria, took on a global perspective

when addressing environmental action, and understood that the United States should hold greater responsibility for addressing environmental issues because we contribute disproportionately more to environmental issues than other countries. Other participants, like Chris and Brittany, felt as though the blame should fall on certain members of society, namely government and those interested in environmental issues.

What prevents us from acting?

Results

Another theme that became readily apparent during interviews was the concept of barriers to action, both past and present. Through this theme I sought to illuminate what participants identified as personal barriers to action, societal barriers to action, perceived barriers to previous generations from acting, and if participants blame previous generations for their perceived inaction.

Personal and societal barriers to action.

As previously mentioned, students attending SI are a broad representation of varying areas throughout Colorado: urban, suburban, and rural. When discussing personal barriers to action, a theme that was common amongst rural students was the idea of being limited in their actions due to where they live. Some participants, like Megan expressed their frustrations brought on by their inhibitions to action due to spatial distance: "I don't do anything at all. It sucks. I wish I could say that I recycled….I don't recycle because the nearest place is two hours away." Megan went on to say that she hasn't "done much, but I want to. But I don't get the opportunity to."

Brittany shared Megan's sentiment of the difficulties associated with being environmentally responsible because of where she lives and her need to rely on automobiles. She feels as though "it is very hard to limit the driving [our family does] due to where we live and the fact that there is no public transport system." Jerome echoed Brittany's reliance on automobile transport by saying that his family drives "three different cars and drive about 300 miles with them each week."

Another theme that was frequently discussed among participants is the idea of human nature being a barrier to action, both personally and in society. Some of the most common downfalls noted regarding human nature were laziness, selfishness, procrastination, diffusion of responsibility, and inability to think long term. One participant, Ashley, feels as though "society is lazy" and that the general mindset of Americans is that environmental issues do not affect us, and "we'll do something when it does. Which then it will be too late."

Some participants discussed the idea of diffusing responsibility on future generations, or people that are motivated to act. One participant, Rachel, feels that "although we have the ability to fix things, we figure that oh hey, we can fix it later." Rachel discussed the idea of procrastination and diffusion of responsibility because there is a lack of apparent solutions to some environmental issues and a feeling of urgency to address others because we have "other problems like the oil spill and we get hurricanes coming in and we put everything to fix that because it's immediate and we know what we can do to fix it." Rachel went further to state that in contrast, "we don't really know what we can do to fix overpopulation….no one wants to think about that because it is too far in the future." With regards to addressing environmental issues, Robert described our

inability to act as though "it's like we are procrastinating." When discussing that it is our nature to think short term, one participant, Brian, made the point that "people tend to usually think about themselves and their children and less about their grandchildren or great-grandchildren."

One participant, Lauren, talked about the idea of society's ignorance of the problems and felt that most people act as they do "because they are not aware." Lauren went further to illustrate our ignorance of our impacts by discussing how "we are so good at shaping and manipulating the environment into what we feel is best for us, but we do not realize the impact of the damage that we have on other parts of it." She went further to discuss that much of our ignorance of environmental issues stems from our lack of connection to nature. "We used to have such an intimate part in [the environment] when we were really a part of it. But as we became more civilized, we grew apart from it."

Some participants noted the idea of being unwilling to forgo luxury to minimize environmental problems, both personally and in society. One participant, Nick, discussed how he enjoys walking into his house when it is very hot outside "and it is 60 inside." He feels as though "it is hard for people like you and me to go grab some water out of the faucet and realize and think that most people don't have that." Another participant, Jawara, echoed Nick's thoughts when describing how people that are used to luxuries would find difficulties if they were no longer available "because that is their style of life."

The idea of societal norms represented both a personal barrier and barrier for people in general to overcome. Jerome feels that as a people, we cannot "just stop what we are doing because it takes a few times to make a habit, but it takes a lot more time to break the habit." Jerome feels that "our habit, like addiction, is oil." Jerome believes that

changes made to address environmental issues cannot be at the expense of a "halt in civilization; it has to be a gradual thing. It needs to be faster, but it needs to be gradual." Another participant, Hannah, feels as though when "society changes, I would change with it, but I am not going to go live in the woods." She went on to describe how changes made to address environmental issues are "something that the culture has to do."

Several participants discussed that tragedy has to occur in order for people to change their ways. One participant, Anthony, illustrated his thoughts using the idea of natural selection and that "people and animals only change when they need to change. If everything is going all good, they are not going to change. And that is the really unfortunate part about our society is that until something really tragic happens, we don't see it; we don't change." Another participant, Samantha, shared Nick's thoughts that we do not act to minimize environmental impacts and issues because "if it doesn't directly affect you, it doesn't matter." Samantha went further to discuss that people do not see environmental issues in their communities, so they do not feel affected.

Another barrier to action discussed by some students was the realization that not everyone is going to care about environmental issues. Or some may initially care, but then "they eventually get worn down," as Heidi, described. She likened the BP Oil Spill of 2010 as an environmental issue that people initially followed, but "after the original week or two, didn't really care." Heidi also discussed how "people have varied opinions" on environmental issues and that you are "not going to get everyone on the boat" which causes the people who are really passionate about environmental issues to not "get as much support for it as they should." Other participants, like Chris, did not like discussing his thoughts on environmental issues and viewed those that talk about them on a regular

basis to be "Boulderites." Because I did not ask Chris for clarification on what he meant by the term "Boulderite", I assumed that he meant liberal-tending environmentally conscious individuals, as this is how I understand the term. Further, the term "Boulderite" is often used in a negative connotation.

"They didn't know better."

When discussing what participants viewed as barriers to previous generations from acting to prevent or reduce environmental issues, many felt that "they just didn't know" the damages being caused, as Heidi posits. In fact, some participants, like Edward, actually feel appreciative for steps taken by previous generations because "they were motivated to continue to further mankind as a species." Though others, like Jerome, feels that previous generations, such as those around during the Industrial Revolution "didn't know any better", but thinks that his parents generations "did know better" and wonders "why weren't they forward thinking enough to fix [the problems]?"

Other participants said that it would be hypocritical to blame previous generations for their inaction because "we can't criticize unless we really take action to show what others did was wrong", as Liang described. She believes that because "we are polluting faster than any of the previous generations"; we are therefore "not doing anything different" and wonders, "how we can feel cheated"? Brian echoes Liang's sentiment, and if placed in their situation, he felt that he "would have done the same thing."

Other participants discussed that they do not blame previous generations for environmental issues because they do not perceive that they have suffered from them. One participant, Kevin, felt as though he doesn't "live in an area that has been impacted"

by environmental issues, and therefore does not blame previous generations for environmental degradation. Samantha shared Kevin's sentiment, stating that she has not been affected personally, and does not feel as though she has "suffered from it." Though she went on to clarify that although she hasn't "been personally affected…I know that we as a generation have."

One participant, Hannah provided unique insight for her perceptions on what previous generations is blamed for "is the whole subsidizing thing." She went on to describe that subsidizing our lifestyle as "added to our whole complacency and expectation for prosperity." She described the idea of subsidizing being required to keep up with our demanding lifestyles and that people think "I deserve to have this, because my parents did, why can't I? And if anything, I did a better job than my parents, so I should be able to have four cars. I should have more cars in fact." Hannah feels as though because of these expectations, we as a culture feel entitled to more consumption.

Discussion

The theme what prevents us from acting addressed research question three, which asked what do students with an aptitude for the sciences perceive as personal and societal barriers to achieving sustainability. Although well intentioned, many participants perceived barriers to taking action to prevent or mitigate environmental issues. For especially rural participants, perceived barriers were due to their spatial distance from amenities (school, work, etc.) or lack of infrastructure (recycling facilities) to demonstrate perceived symbolic environmental behavior. This barrier is best illustrated through the dependence of many United States citizens on the automobile. As Jerome

noted, his family lives in a remote rural area which requires he and his family to not only drive hundreds of miles a week to meet their needs, but also rely on multiple automobiles because their needs are located in different areas. Several potential solutions to Jerome's family's reliance on automobiles include: move residence to a location closer to their amenities, choose work or school locations in greater proximity to their residence, carpool with family members, friends, or co-workers, or bicycle commuted if the road infrastructure permitted. Though depending on their circumstances, perhaps none of these potential solutions could be a reality and Jerome is stuck depending on relying on the automobile.

Besides barriers stemming from structural deficiencies, participants mainly discussed barriers to preventing or mitigating environmental issues from pitfalls in human behavior. Participants noted concepts such as laziness, selfishness, short sightedness, and helplessness as pitfalls in human behavior. Participants also commonly talked about the concept of humans being unwilling to act unless directly provoked. In other words, participants felt as though society will not change their ways unless forced to do so when met with environmental catastrophe. However, none of the participants predicted what environmental catastrophe, if any, would be enough to awaken societies concern for environmental issues. To take a step further, participants felt that by the time society realizes there are environmental issues that require addressing, it will be too late to act.

Some participants implicitly discussed the power of labels in terms of societies perceptions of individuals. Some participants, like Hannah, identified that changes are needed personally and in society to prevent or mitigate environmental issues. Though she

did not feel compelled enough to make the changes needed to promote environmental behavior unless society changes with her. The Theory of Reasoned Action (Ajzen & Fishbein, 1980) would posit that the subjective norm arising from normative beliefs that society enacts prevents oneself from performing a given behavior.

Many terms that are used in society to describe a type of person can hold a negative connotation. Currently, the term "treehugger" is used to describe an environmentally conscious individual, but may be taken as a negative connotation from either the issuant or the labeled. This concept was supported by Chris' comment about people concerned for the environment being considered "Boulderites", or abnormal, in his opinion.

When asked what participants identified as barriers to previous generations inaction, they commonly responded that they simply did not know any better. Participants felt as though previous generations have been completely ignorant to environmental degradation, and that we are only now seeing the results of our impacts on the environment. Therefore, they were unaware, and thus cannot blame them for damages caused. Whether ignorance of previous generations was real or imagined, participants alluded to the concept that damages done to the environment in the past are their responsibility (as well as everyone's) to address now, whether they like it or not. Interestingly, participants went against the notion of the current generation not taking responsibility for their actions (Wray-Lake et al, 2010). Even further, their responses in the interviews demonstrated participants willingness to not only take responsibility for their actions, but previous generations actions as well. Whether this is only verbalized or actively worked upon by participants and the current generation is unknown.

Responsibility for the Future

Results

Figure: Future Careers Tagxedo

Figure 5 is a tagxedo that demonstrates the careers listed by participants when asked what fields they plan to pursue in the future. A tagxedo is a visual cloud of words in which words used with the greatest frequency are appropriate sized to show their proportion of use. In the case of figure 5, the top career choice listed by participants on their career goals assignment (Appendix G) were compiled and then inserted in to tagxedo to visually demonstrate the frequency of careers listed.

The most favorable careers listed among participants were fields in engineering and medicine. Specific engineering fields listed by participants included: environmental engineering, aeronautical engineering, mechanical engineering, nuclear engineering, and civil engineering. Specific fields in medicine listed by participants included: dentistry, medical doctor, plastic surgeon, nursing, and emergency room doctor.

A large proportion of SI alumni go into their desired professions in the Science, Technology, Engineering, and Mathematics (STEM) fields. It is likely that the majority of SI 2010 participants will follow similar trends, and indeed, end up pursuing their desired professions. Although many participants verbalized a strong drive to pursue their desired professions, some participants were still unsure of their future careers at the time of data collection. For example, Jiao had an interest in pursuing a career as an environmental engineer, but was not exactly sure of "what they do", but was aware that "they do something with the environment." It is unsure whether her mind will be changed on her chosen career as she learns more of the job description of an environmental engineer.

Also apparent in Figure 5 is that some of the participants do not plan to pursue a career in what is traditionally considered a STEM discipline. For example, Lauren plans to pursue a career in Anthropology. Another participant, Cody, plans to pursue a career in Cognitive Psychology.

Incorporation of environmental issues into future career.

All participants interviewed did not explicitly state that they would not incorporate environmental issues into their future careers. Some participants noted that they had never thought of incorporating environmental issues into their future careers, and were thus unprepared for the question posed. Others were uncertain of how they could incorporate environmental issues into their future career, and said what came to mind as a feasible connection. For example, Josh plans to pursue a career in Astrobiology, and wonders if he could perhaps "learn things from other planets?."

Another participant, Chris, responded, "possibly, and just possibly (this is off the top of my head), doing something like what you are doing right now." As mentioned previously, Chris plans to pursue a career in cognitive psychology, and he perceived my research (which I disclosed openly to participants) as determining "what are people thinking about [the environment] and what rationale…[is] being used to derive these certain opinions?."

The majority of participants interviewed plan to address environmental issues either directly or indirectly in their future careers. Interestingly, many of the participants interviewed planning to directly address environmental issues intend to pursue a career in engineering. For example, Jawara hopes that through engineering, he can develop ways to "reduce the pollution in the air." Another participant, Maria is unsure of exactly what she wants to pursue as a career, but feels that sustainability "is a big thing." She discussed many opportunities within the field of sustainability, but expressed an interest in becoming a "decomposable materials engineer."

Other participants were interested in addressing environmental issues through the development of alternative energies. One participant, Samantha, has an interest in Hydrogen power "for the sole reason that it isn't bad for the environment." She feels that if she "was able to work on Hydrogen power, or even contribute at all to perfecting it to where everyone can use it, then that…would help." Another participant, Jerome, feels that clean energy development is vital to the future because "we can't clean up the messes that we've made unless we have the energy to do it."

Role of religion/spirituality on perceptions of environmental issues.

Another question posed to participants was what role religious beliefs/spirituality played in their thoughts on the future with regards to environmental issues. To note, not all participants discussed openly their personal beliefs. Some of those that stated that religion/spirituality did not play a role in their beliefs either declined to elaborate on their personal beliefs, or discussed their connection to the future of the environment from a non-religious or non-spiritual viewpoint. Those that did say religion/spirituality played some role tended to elaborate on their personal beliefs.

As noted, some participants that stated that religion/spirituality played no role in their thoughts on the future with regards to the environment did not elaborate. One participant, Nick, said that he is "not very spiritual or religious" and he never "think[s] about that stuff with relation to the environment." Another participant, Ashley, said that religion/spirituality does not play a role, though she does not "think that the world will end in 2012."

Other participants discussed that religion does not play a role in their perceptions of the future in terms of the environment, but they did elaborate on the role of their spiritual beliefs. Maria stated that she is "not a particularly religious person", but she is spiritual and values "life at every form", which makes her "environmentally inclined." Lauren echoed Maria's lack of religion, but identified as a "spiritual person" that takes lessons from different religions such as "Buddhist beliefs." If given the choice, Lauren "would go back in time and live with the Native Americans just because they were that much closer to nature and the Earth." Megan echoed Maria and Lauren's connection to the Earth and labeled herself an "Earth muffin."

Edward felt that his "lack of spirituality is in fact an important factor in [his] thoughts about the future with regards to environmental issues" because he "sees the need for a sustainable environment as an important issue in that I am in favor of the continuation of our species." Hannah disclosed that she is "totally lost as far as spirituality goes", but feels as though she has "a really strong moral compass." She feels that addressing environmental issues is important because she would "feel guilty if I could look in the future and see what I had done to make to make other people suffer."

Of the students that discussed their religious/spiritual beliefs playing a role in their thoughts of the future in terms of the environment, many discussed Christianity and the concept of stewardship. Heidi discussed that the Christian Bible directs us "to be good stewards of what we own" and she feels that it is "important to try and preserve and try to be good stewards of what God has given us." Though another self-identified Christian, Dave, felt as though religion told him to "not necessarily to worry about [the environment]" and that his church "looks down upon environmentalists and doesn't think that their views are the most important." Dave felt that in opposition to his religious/church views, the environment is a "pretty pressing issue to [him]" and therefore created "pretty conflicting viewpoints." Other religions briefly described by participants were Judaism and Hinduism.

Role of parental beliefs on perceptions of environmental issues.

It was also of interest to investigate the role of the participants' parents' beliefs of environmental issues on constructing their own beliefs. When asked about the role, participants were either unsure of their parent's beliefs on environmental issues, aligned

with their parent's beliefs on environmental issues, or not aligned with their parent's beliefs on environmental issues. Further, some participants who discussed holding opposing views to their parent's regarding environmental issues discussed how it allowed them to broaden their perspectives.

When discussing the role of his parent's beliefs on his own regarding environmental issues, Nick felt as though he is "pretty well aligned with them." Though when asked to share how much he discusses environmental issues with his parents, he admitted "not much" and discussed how his mom tells him to "stop running the AC because the bill is higher….but she doesn't say stop running the AC because I am hurting the environment because I am using more energy." Other participants like Anthony and Robert discussed how they do not generally talk about environmental issues unless an environmental catastrophe is currently occurring, such as the "gulf oil spill." Ashley noted that she is unaware of her parent's beliefs on environmental issues and feels as though her "parents don't really care, or if they do, they just never talk about that kind of stuff."

Other participants, like Edward, identified themselves as being aligned with their parent's views on the environment. Though Edward felt as though his "parents are much more opinionated on these topics than I am." Chris also felt as though his parent's beliefs reflect his own "very strongly." Jawara echoed Edward's and Chris's alignment with their parents by stating that his parents "taught [him] to not use more than [he] needs."

Other participants, like Brittany, stated that their beliefs on environmental issues contrasted greatly from the views of their parents and thus did not influence their beliefs. Another participant, Brandon, shared Brittany's contrast from his parent's beliefs on

environmental issues. Brandon identified his father as not "environmentally-conscious" and feels as though "his father isn't out to damage the environment, but he puts his comforts before it." Some participants identified aligning with one parent on environmental beliefs while not aligning with another. Samantha felt as though her "dad is really different" and that he "doesn't care" about environmental issues but identified her mom as "hard core" in terms of caring about environmental issues. Samantha felt as though she "more lean towards" her mothers beliefs.

Some participants discussed the idea that disagreement with their parent's beliefs about the environment allows them to broaden their perspectives. Hannah felt as though her disagreement with her father on environmental issues was a benefit because she felt that "sometimes it's hard to understand someone's views until you've met someone like that and you can understand where [they are] coming from." Megan echoed Hannah's thoughts by stating she is "glad [her parents] believe what they believe because [she] is able to see that side of it." Heidi discussed how disagreements between her parent's regarding environmental issues is "interesting" and her parent's allow her to "make [her] own decisions about everything."

Relationship between science and environmental issues.

Participants were also asked to discuss the relation between science and environmental issues. Among the most common themes in responses were: everything is related to science and is thus interconnected, scientists study and solve environmental issues, and scientific exploration both causes and solves environmental issues. Many participants, like Heidi, discussed how environmental issues "are all related to science."

Chris discussed how "everything is interconnected" and mentioned the concept of "spaceship Earth", a concept which likens the Earth to a spaceship with limited resources and room. Samantha felt that "it is all intertwined" and discussed that with science, "you can see what is changing."

Many of the participants, like Nick, feel that "science is pretty much the only way we would overcome these [environmental] problems." He went on further to say that we need "science to fix the problems." Dave shared Nick's sentiment by stating that "science is to define these [environmental] problems and the effects…and engineering is to fix [environmental problems] and technology is to implement [solutions]." Rachel felt that scientists "tend to have more of an open mind" and are more forward thinking. Therefore, she felt as though "scientists…people who work with technology and stuff…have the greatest ability to impact what's going to happen" with addressing environmental issues.

Some of the participants, like Brittany, felt that "because of science we have environmental problems and because of science we will rid ourselves of these problems." Both Brittany and Megan used the examples of cars to illustrate their views. Below is how Megan illustrated her view of cars:

> Science is how we came up with our cars, how we came up with how to get the oil, how to use the oil. And these are all great ideas, but nobody was thinking long term. Now we are being forced to think long term. So science is helping with that.

Discussion

As demonstrated in the future career tagxedo (figure 5), many of the participants plan to pursue various fields within engineering and medicine. Participants interested in pursuing a career in engineering identified various ways that they could aid in mitigating

environmental issues through developing new technology or different production systems. The notion of inventing ourselves out of environmental degradation seemed a common sentiment among engineering-minded participants. Interestingly, this sentiment is different than data previously obtained in which participants described the need for education, awareness, and altering human behavior in order to mitigate environmental issues. However, this could be indicative of how participants perceive of their personal role within preventing or mitigating environmental issues while needs such as education, awareness, and altering of human behavior are the roles of society at large.

The theme responsibility for the future addressed research question five, which asked what roles does spirituality/religious beliefs and family influence play in perceptions of environmental issues. Based off of findings of White (1967), I expected that participants identified as not religious would tend to be pro environmental while participants identifying as Christian or other religious groups would be less pro environmental. However, results obtained in the study do not support this. In contrast, most of the self identified religious participants tended to have pro environmental sentiment. Further, some of the self identified non-religious participants tended to have less of a pro environmental sentiment. When discussing the role of religion in their environmental beliefs, many of the identified Christians cited the concept of being Stewards of the Creation and not careless dominators. Therefore, the results obtained in this study align more closely with studies conducted by Wolkomir et al (1997), which found that religious saliency had little impact on pro environmental sentiment.

Similar to results obtained regarding the role of religious beliefs and saliency of concern for environmental issues, participants demonstrated no consistent pattern with

role of family beliefs/values and saliency of concern for environmental issues. Some participants identified that they align with their parents on concern for the environment and environmental issues, though there was no pattern in greater or lesser pro environmental behavior in relation. In other words, some participants, such as Edward, identified his parents as concerned for environmental issues, and that he generally aligned with them. Similarly, Chris identified as aligning with his parents on concern for environmental issues, yet revealed that conversations about the environment with his parents occurred rarely, if at all.

Therefore, some of the participants that identified that they aligned with their parents on environmental issues admitted that they never conversed with their parents on environmental issues, and thus assumed that their views aligned. Also of interest to note is that for some of the female participants (such as Samantha), it was evident that they aligned more closely with their mothers on environmental issues rather than their fathers. This may be indicative of 1) females tending to demonstrate more pro environmental attitudes (Zelezny, Chua, & Alrich, 2000) and 2) female participants modeling off of female role models such as their mothers for guidance in pro environmental attitudes and behavior.

Emotional Impacts and Visions of the Future

Results

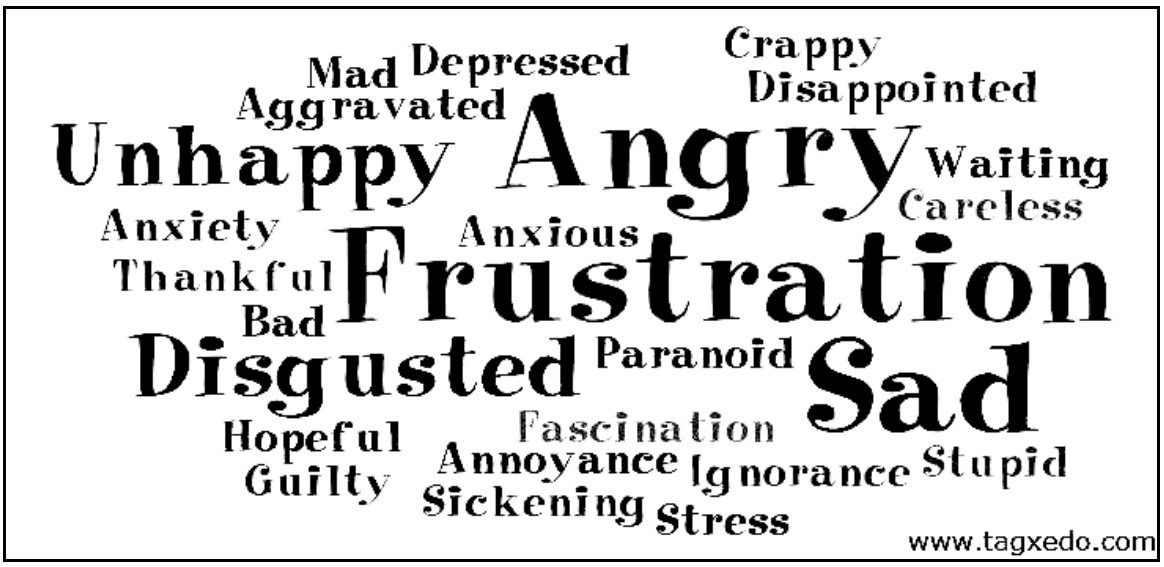

Figure 6: Emotional impacts Tagxedo

Figure 6 is a tagxedo demonstrating the words most commonly used by participants to describe emotional impacts of internalizing environmental issues. Among the most commonly used words was frustration, anger, unhappy, disgusted, and sad. When discussing the impact of internalizing environmental issues, Heidi felt "disgusted in a sense that we let this happen." Megan discussed being angry, "not at just other people, but at myself because I am guilty of it….like littering and 30 minute showers and stuff like that. I have bought in to that." So she feels "angry that [she has] been stupid."

Some participants, like Robert, could not peg just one emotion to how he internalizes environmental issues and said it is different from day-to-day. Some days he feels sad from what he learns about environmental issues, while other days, he is driven to research environmental issues to learn more. He feels as though "the more people we have thinking about it, the more likely I can find an answer. If I start thinking about

something now, down the road, I may have the answer." Samantha described how internalizing environmental issues make her feel in the context of what she had learned in history classes:

> We know that certain Monarchs are awful people, like Hitler…and the people who think they rule the world and everyone should obey them. It kind of seems like we are doing that with the environment…Although I do think that humans are the top chain because we're intelligent, we are kind of messing up the rest of the world just for our own selfish needs…Not a good feeling comes from it. Just not happiness.

Outlook on the future.

Participants were asked to discuss their outlooks on the future, in terms of the environment and society. Three major themes arose, which were: the future will be as bad as today or worse, the future will be the same as today or better, or the future is uncertain, and can be bad or good depending on our actions taken currently. Some participants felt as though the future of the environment and society will initially be bad, but will eventually get better. For example, Hannah feels as though "we have a lot of serious crises, especially environmental, coming our way." She discussed that the future will be "pretty bad", but "human ingenuity is going to get us through a lot." Therefore, Hannah doesn't "see the demise of humanity" but instead feels like "people's ingenuity will eventually prevail, but at a cost." Because of this view on the future, Hannah calls herself "relatively optimistic."

Some participants, like Rachel, are pessimistic about the future of society and the environment. Among some of her predictions are "no more open spaces…a lot more industrial complex zones…a lot more housing and people", which will lead us to go "into a really bad depression." Ashley echoed Rachel's pessimism of the future by predicting

that “there will be big industries polluting everything more than they already have.” Another participant, Sapna, feels as though we will “only notice [environmental issues] when it is too bad, and [we] can’t go back and change it or help it.” She identified that as a generation “we don’t really care as much.”

Other participants, like Lauren, feel like “at the rate we are doing now, [the future] is not looking too hot.” Lauren predicts that in the future, “all kinds of cities would be within 5 miles or 10 miles of each other instead of like 20 or 30” and that we will “lose a lot of wildlife” because “they are not able to adapt to what it takes to live in areas like this.” Anthony exemplified participants who felt as though the immediate future (within 50 years), “will be the same and people won’t have changed.” Though he feels as though the distant future “is going to be bad” and that “little things [will happen] more often”, and eventually in the long term (hundreds of years) “something really bad [will] happen.”

Other participants, like Megan, hope that “we are going to have a sustainable life” in the future, but she does not “think that is going to happen.” She feels as though nobody “is going to pay attention to the environment enough that it is going to change.” She predicts that in the future, there will be “barely any forests left” and there will “be a lot of wars and fighting over resources.” Liang echoes Megan’s concerns and feels as though “the environment will continue to get worse and eventually men will destroy themselves because they will start doing irreversible damage to their home.” Because of these sentiments, many participants, like Brittany, feel as though “the future is a very scary thing to think about.”

Participants, like Samantha, feel as though the future will "kind of be the same" and that differences will be that "technology would be a lot more developed" with "a lot more stuff helping the environment" and the environment will get "better, at least moderately." Josh feels as though "we are on the brink of change in society." On the whole, Heidi feels as though "there will be optimistic things but at the same time [she thinks] we will be missing a lot of species."

Dave feels that in the future of society "things will be more evenly distributed" and that we will "be a more unified community as a whole, like think of the Earth as a community instead of different nations." He feels as though this re-distribution "will become more attractive to people" through "people with those interests taking higher positions in influential positions in governments." Brian echoes Dave's thoughts on changes in society, and feels that it "will either change drastically by choosing to or by force" and feels as though "our lifestyles will be very different, very soon, in the next 50 years." Jawara feels that in the future, we will "share everything we have together" and we will "have a community and live together" instead of "by yourself", allowing us to be more "social."

Other participants, like Chris, feel that in the future, "things are still going to be green…some people are going to be hurting the environment, other people are going to be helping it…[so] it will balance out." Edward feels as though the future is not "all that bleak", and we will eventually "confront the issues with our way of living and will be forced to do away with our bad habits." Therefore, "issues will be almost entirely resolved…[and] society will be more environmentally conscious." Nick echoes Edward's sentiment that "we would stop before [the environment] got to that level and gradually

people would get more efficient." Nick expands further that the future "may get worse for a little bit, but over time it should eventually get better."

Some participants, like Maria, feel as though the future "depends on where we go as a society." Robert echoed Maria's uncertainty and feels as though the future "could be bad", but identifies as "an optimist", so chooses to "go with [a] good" outlook on the future. Other participants, like Jerome, feel as though "if we keep up on the track we are going now, it's pretty bad", "but if we keep up with going towards green, then I definitely [see the future] as a place where we can breathe easier and have less waste." Though Jerome did note that it is important that we learn from history "and not repeat the oil crash of the 70's when [the United States of] America reached its peak oil production and then we found [oil] elsewhere in the world…[and] forgot all about our alternative energies."

What provokes thoughts on environmental issues?

When asked what provokes thoughts on environmental issues, participants tended to fall within one or more of the following categories: when I talk with people about them, when I see things that remind me of them, when I hear things about them, and when I think about things relating to them.

Many participants stated that they think about the environment and environmental issues "when people bring up stuff about [it]", as Rachel shared. Brian discussed how environmental issues come up through "conversations with my parents...[and] with my friends." Edward provided the following insight regarding what makes him think about environmental issues:

> What stimulates me to think about environmental issues is when people express opinions about the issues that I am not sure I agree with. Often, when I listen to other people present their ideas, I am skeptical, which forces me to form my own opinions, but only after a sufficient amount of premeditation.

Other participants, like Maria, discussed how they think about environmental issues when they see things, such as "the beauty of nature", as Maria described. Maria described further that she thinks "of things as a process" and about how we "mass produce all these things…but we throw them away like it's nothing and it makes me think about where they go. How does that affect things?." Sapna echoed Maria's admiration of nature and being reminded of environmental issues when she goes "to a place that is really beautiful." Heidi described how litter on a hiking trail seen in Rocky Mountain National Park triggered in her mind a comment read in the book *Fast Food Nation*, and described "if we were to all die from a nuclear attack, what will be left is the wrappings…I think that is a really sad thing. What will be left of us is not the good stuff, but burger wrappers." Heidi also mentioned that she thinks about environmental issues "when I am growing my garden" and reflects on the "finite resources of water."

Nick is reminded of environmental issues when he sees things like "a bunch of trash on the side of the road…[or] a trash can full of food that is perfectly good." Megan thinks about environmental issues when she "see[s] new buildings being built in [her] town." Megan discussed how a mall is being built in a field where she once fed horses, and "now there is no horses…and that is terrible."

Lauren described how she thinks about environmental issues when she "drives through the city and see[s] all of the smog in the air." Similarly, Ashley is reminded of environmental issues by "power plants…because you can see what they are doing to our atmosphere." Ashley went on to say that she doesn't think about environmental issues with cars because "you don't usually see what [they're] doing."

Several participants stated that they think about environmental issues when they hear about them, particularly from the news or media. Jawara noted that he sees environmental issues "on t.v." and he tries to "get information about the environment", which makes him "see that we really need to change our lives." Josh is informed of environmental issues from the "news", and the "constant updates on many environmental issues."

Participants, like Robert, discussed how they think about environmental issues "in general everyday." Robert stated that he often thinks about environmental issues while working and noted that he "has a mindless job…I pull a lever." Samantha shared that she thinks about environmental issues when she "is given a specific problem" and discussed how her teacher "would give us a question-of-the-day type of thing" in class. Dave thinks about environmental issues when he reflects on "how [he] enjoys things [and] how it may be different for future generations if these changes happen in the environment and they won't be able to enjoy the same things that I enjoyed personally."

Envisioning Happiness.

When asked to define what happiness meant to them, the participants shared a variety of factors that brought happiness to their lives. Responses to what makes participants happy include: experiencing contentedness, prosperity, success, doing what you love, spending time with people you love, having a purpose, living in a healthy environment, being personally healthy, raising a healthy family, and being able to look back on life and be able to say "that was awesome", as Nick stated. Though some participants, like Megan, noted that happiness for her would be not having to deal with environmental issues, but realizes that "we have to solve the problems so that we do not have to solve any more…we have to fix this, then we can be happy…I don't want to, but I am going to."

Envisioning the Future.

I grouped participants' responses of how they envision their future into three major categories: futures envisioned with the environment in mind, futures envisioned with the environment not in mind, and a general avoidance of thinking about their futures. Some participants, like Jawara, had a negative outlook of their futures. Jawara feels as though "in our future we are going to suffer. We are going to have more technology, more things that make pollution in the air, [and] more things that impact the Earth."

Other participants, like Megan, felt as though she will "be successful" in the future, though she also hopes that she will "have an impact on [environmental]

changes." Megan went further to say that her future actions wouldn't be "enough. We need more people." In her future, Ashley envisions "being married, living on a farm, and hopefully raising healthy children" though feels that "as the environment is getting worse, so is the health of everyone" and is therefore "not really sure what to expect" of her future. Liang shared Ashley's uncertainty about the future:

> To be quite honest I don't really know how my future will look. I want to think that just me doing my part will give me a protection bubble around pollution, but it does not. Everyone needs to do their part or we will all be doomed to face the consequences of our actions.

Some participants, like Samantha, did not incorporate the future of the environment when describing their personal future outlooks. Samantha mainly discussed that she hopes to "reach [her] goals" and "have a good life." Jiao feels as though her future is "going to be nice" and predicts she will "have a pretty good job" and a "nice house and live around [a] place where there is lots of grass and trees and birds and animals." Brittany echoed Jiao's outlook on a positive future by predicting that she will be "prosperous with a great life." Anthony feels as though in the future he will "be a world changer" and hopes he will invoke changes "through [his] passion for molecular biology." Heidi shared visions of her future as incremental, and sees herself in the next five or ten years "owning a house with some land where [she] can grow a nice garden and just have a dog."

Other participants, like Josh, either explicitly or indirectly stated that they do not like to think about their future. When asked how Josh envisions his future, he confessed "rough and uncertain." Lauren discussed how thinking about her future causes her stress "because sometimes I feel like I am just growing up way

too fast and everything is going by way too quickly." Lauren later stated that she could see herself "doing what I can to live my life and do what I want and be happy and affect other people in a positive way." Rachel "would love to do something with my life that is meaningful and will get people to pay attention to what's going on…but I don't know if that is going to happen." Jerome shared the following insight regarding his future:

> I don't try to envision my future very often. I am always nervous about whether I am going to do what I want to do and I'm not going to get stuck doing something because of my laziness or something like that. Because everyone's got problems, and mine is probably procrastination.

Discussion

The emotional impacts and visions of the future addressed research question two, which asked what emotional impacts are associated with internalizing thoughts on environmental issues. Overall, the words used to describe how participants internalized thoughts about the environment were negative. In other words, participants rarely used positive words when describing how they internalize thoughts about the environment. Through looking at the words used by participants (figure 6), I infer that overall, participants were unhappy when internalizing thoughts on environmental issues. The overall negative connotation participants associated with environmental issues may arise from their sources of information regarding environmental issues.

Though interestingly, some participants had a difficult time associating an emotion when thinking about environmental issues. For example, Josh identified that he "doesn't worry about [environmental issues]. I am not a worrier." Josh's response to the question is representative of others who did not assign an emotion to internalizing

environmental issues. Several reasons may exist for this: 1) the question was not understood and thus participants responded how they deemed appropriate, 2) participants had not previously pegged an emotion to internalizing environmental issues, or 3) participants had difficulties vocalizing emotions and thus avoided answering the question.

No consistent pattern was demonstrated in participant responses regarding the alignment of pro environmental sentiment and outlook on the future. Based off my preconceived notions, I initially assumed that participants demonstrating greater pro environmental sentiment would have greater concern, and thus negativity for the future of the environment and participants demonstrating less pro environmental sentiment would have less concern. However, participants across the spectrum of pro environmental sentiment demonstrated varying outlooks on the future of the environment. For example, Heidi represented a participant with relatively strong concern for the environment and environmental issues, and espoused a positive outlook on her personal future, the future of society, and the future of the environment.

Also of interest to note is that overall, participants aligned closely on how they envision happiness in that they all listed characteristics contributing to quality of life and not standard of living. None of the participants discussed happiness as being wealthy in terms of money, or listed items they would acquire to bring them happiness. Instead, participants focused on concepts such as contentedness, having good health, and being surrounded by loved ones. Even further, some participants discussed happiness in terms of the environment and identified that health of the environment is entwined with their personal happiness.

Similarly, some participants envisioned their personal futures with the quality of the environment in mind. Though many of the participants did not include the quality of the environment when envisioning their futures. Further, many participants expressed negative outlooks concerning the future of the environment, though described their personal futures in a positive outlook. Therefore, a disconnect may exist in many of the participants minds when it came to connecting that the health of the environment will play a role in their ability to endure in to the future.

Sources of Information

Results

When asked where they obtained their information regarding environmental issues, the participants described a variety of sources. The most common sources for environmental issues prior to attending SI included: previous exposure in school, coverage in the media, research initiated through personal interest, and information shared by or discussed with a personal acquaintance. Some participants discussed their sources of information regarding environmental issues gained while attending SI and included: an educational camping trip to Rocky Mountain National Park, an educational field trip to Colorado State University Engine Conversion lab and lecture on Green Building, mentored research projects, the Sustainability class, interacting and discussing environmental issues in a comfortable environment, and discussions had with varying professionals introduced throughout the program.

Heidi exemplified participants that had previous exposure to environmental issues through taking a class in high school, Advanced Placement Environmental Science

(APES). Through the class, Heidi was exposed to environmental issues through "watching videos." Jerome echoed Heidi's exposure from school, as he took a class "called Environmental Science and Alternative Energies." Jerome discussed that his interest in alternative energies was also piqued because the school he attends "got a new wind turbine", which he found "really fascinating."

When asked about his sources of information regarding environmental issues, Chris stated the "Boob tube." When prompted further to determine if school had provided any information regarding environmental issues, Chris said "not really" and that he attends "a geek school where they are more talking Calculus then save the Earth!." Other participants, like Edward, discussed the influence of media on societal perceptions of environmental issues, and not his own. Edward shared the following insight when reflecting on the polarity often seen in media when media sources discuss environmental issues:

> A lot of the time, these [environmental] issues are discussed only at one of two extremes: that the environment is not really of concern or that all of mankind needs to drastically alter its ways of living. It is for this reason that often people's opinions on these issues are biased. I openly admit the likely possibility that my opinions are biased on account of the context in which I first learned about the issue.

For Brittany, a personal interest in environmental issues has prompted her to conduct personal research to expand her knowledge. In particular, Brittany discussed that interacting with her sister, who is a civil engineer, has prompted her to think about "water issues" and traveling in Europe introduced her "to their lifestyle of transportation." Brittany went further to discuss that her surrounding has had an impact on her thoughts of environmental issues and that she "want[s] to do something that makes farming and agriculture more sustainable."

Other participants, like Jerome, noted their relations and subsequent discussions with personal acquaintances regarding environmental issues. As mentioned previously, Jerome took an Environmental Science class prior to attending SI. Jerome went further to discuss the impact of his former teacher by stating that he was "a total hippie and so he talked to me and I am really close to my teacher and so we talk all the time." Jerome further illuminated the impact of his friend becoming a vegetarian. Initially, Jerome identified as a "really big conservative" and felt as though "the Earth can take care of itself." Though after conducting personal research, he realized that "no, it can't."

Some participants discussed their sources of information regarding environmental issues as sources obtained through attending SI. Some participants, like Sapna, discussed multiple sources for her newfound information regarding environmental issues. In particular, Sapna highlighted her research conducted in SI regarding water quality, which showed her that "our water isn't as great as we think it is." Sapna also discussed her experiences while attending an educational field trip to Rocky Mountain National Park, in which she reflected on "if we keep at what we are doing, we might not even have our wild mountains." Heidi also discussed the impact of Rocky Mountain National Park because her "family doesn't go camping that much, so it was cool to see that."

Brian exemplified participants who were motivated by what they learned on an educational field trip to Colorado State University (CSU). Brian stated that he "really enjoyed the tour of the engines [conversion] lab at CSU." He went further to discuss that what he learned about regarding alternative energy gave him "hope." Another participant, Maria, identified the field trip to CSU as the first place that she had "learned about green building."

Several of the participants, like Samantha, highlighted the impact of mentor-guided research projects as augmenting their information regarding environmental issues. “Since I was here I discovered the whole Hydrogen Power thing, which I wouldn’t have found otherwise. So I think it is really cool and it opened my eyes to how Chemistry can relate to Environmental Science and how it can make a difference.” When interviewed several months post program, Samantha (recently accepted to Colorado School of Mines) has held on to her passion for Hydrogen power, and plans “to study environmental engineering at the Colorado School of Mines this year, and learn more about alternative energies and spend my career perfecting hydrogen power and other more sustainable and healthy energy sources.”

Jerome echoed Samantha’s interest piqued through his mentored research project. Jerome noted that prior to SI, he “didn’t really think I wanted to do that type of stuff with my life.” Though through “fate”, Jerome’s research project focused on “something that I’ve been talking about this whole entire time. Just producing energy positively.” To clarify, Jerome often discussed the concept of positive energy production as a means to create energy without relying on fossil fuel inputs. Jerome feels that what he conducted for research during SI “could definitely be something I do with my future.” Liang echoed Jerome and Samantha’s positive experiences in their mentored research by stating, “the project I worked on especially gave me the confidence that I can make a difference.”

Some participants noted the impact of taking a class on Sustainability during SI on influencing their perceptions of environmental issues. Jawara noted that he “didn’t know about sustainability before I came [to SI].” Megan also stated that she “didn’t know about sustainability” and shared the following insight:

> Everyone always says we are going to be the generation that has to change the problems, fix the problems. Now I actually see that we do. I didn't really think that before…I get it now.

Another participant, Josh, felt as though the sustainability course "filled in a lot of details on environmental issues. I mean, I know we were just grazing the surface, but it helped. A lot." Edward echoed Josh's sentiment by stating that he "found the course to be intellectually stimulating." Other participants, like Nick, identified as "aware of a lot of stuff" regarding environmental issues prior to his exposure to them in SI. Nick stated the following regarding the impact of the course on his environmental perspectives:

> It gave me a little bit of new insight. At least in the short term. I don't know what I am going to be doing 6 months from now. But in the short term, I am a little more conscious of how much we waste everyday and stuff like that. It has made me think about everything a little bit more.

Instead of just listing one aspect of SI as being impactful, many participants discussed SI as a whole as having an impact on their perceptions of environmental issues. Hannah exemplified participants impacted by professionals she has interacted with because of her attendance at SI. "Every person I have talked to has given me a new perspective on life. I am loving it." Other participants, like Rachel, discussed how attending SI allowed her to openly discuss environmental issues. "[SI has] helped me to be around everyone because they think more the way I do, so I feel like I am learning even more because of that." Maria echoed Rachel's comfort with discussing environmental issues openly, and identified SI as "the environment to [develop] bonds, but at the same time to respect one another and their scientific values."

Discussion

The theme sources of information addressed research question six, which asked what are student's major sources of information regarding environmental issues. When asked where they have learned about environmental issues, participants identified a multitude of sources. Interestingly, participants described their sources of information both before the program and during it. This may have resulted from the varying times during the program in which participants were interviewed. However, a definite trend in knowledge and awareness of environmental issues was prevalent in participants who identified as previously taking a class on the environment prior to attending the program. This finding correlates with studies positing that individuals who have greater knowledge of environmental issues tend to be more pro environmentally inclined.

International students perspective

Results

Several participants identified that they are originally from countries other than the United States. In particular, two of the participants are from different regions in China, one of the participants is from India, and one participant is from Senegal. In addition to asking these participants the questions asked to all participants, I asked them to discuss the differences between perceived environmental issues from their home countries versus the United States.

When discussing differences between China and the United States, Jiao that "some people do think about environmental issues, but not as many in China." Jiao went further to discuss the state of recycling in China:

> We don't really have recycling bins. We used to have them, [and] for the first several months, people [recycled]. Afterwards, people just stopped, and the media stopped talking about it, and it just doesn't work.

Liang is also from China, and describes her times growing up alongside the Yangtze River as a child:

> I lived by the Yangtze River and the river is absolutely disgusting. My Grandfather tells me stories of how beautiful it once was when he was a kid. And that just got me thinking that in probably 50-60 years, pollution destroyed a huge river. If it continues, how much damage are we going to do to our environment by the time I'm my Grandfather's age?

When discussing differences between her home country, India, and the United States, Sapna highlighted the concept of environmental regulations. "It's not as strict as it is here." Sapna also noted that when she goes to India to visit, "the moment I get off the plane, I can tell it is totally different. The air is totally different." Sapna went further to discuss her perspective on India and her subsequent preference of living in the United States:

> I think we are better here. Because there, they don't even have paved roads, and it's not like really well kept, but it's still kind of dirty…My parents grew up there, so they don't notice it as much, and they don't really care…When I go back, like I love it there, but I probably wouldn't want to live there because it's so dirty and stuff. And it's just the way I've been raised in a better environment that I'm kind of thankful for that. But at the same time I feel for those that are still there because they don't have the same opportunities.

When discussing what he viewed as major differences between his home country, Senegal, and the United States, Jawara discussed the disparity in education:

> I think in my country [they] don't know really what the impact of what we do in the environment because for the most part they don't have education, they didn't go to school, and even if they did go to school, they don't have a good background because they don't have the money. They really don't know too much about the environment or the impact we do. I'm sure that

> if you go over there and ask some people if we hurt the Earth, they are going to say that they don't know because they do not see the impact. They don't care.

When asked specifically what types of environmental issues are different in his home country versus the United States, Jawara discussed deforestation and that "the forests are decreased because the people use the trees to cook [and] to build homes." Jawara linked deforestation to desertification, saying "in Africa, we have the Sahara, and that is a big land without trees…desertification [is] big over there."

Discussion

The theme international students perspective addressed a subset of research question one, which asked are differences apparent in perceived environmental threats and solutions between immigrant student's verses native students. All international participants verbalized a difference between perceived environmental issues in the United States versus participants' home countries. For Sapna, Liang, and Jiao, reflections on environmental issues from their home countries India and China circulated around the concept of pollution. All three participants noted in their dialogues varying issues of pollution in their home countries. In contrast, Jawara spoke mainly of the deforestation, desertification, and lack of education as major differences between his home country in Eastern Africa, and the United States.

Interestingly, two of the participants (Jiao and Sapna) discussed their preference for the United States, and invoked a sentiment of "otherness" to

problems of their home countries being exclusive to them and not prominent in the United States. This sentiment may be indicative of the time since living in their home countries. However, it is unknown from the data obtained how long ago participants have lived in the United States.

Closing Thoughts (from interviews)

Results

At the conclusion of every interview, I asked participants if they had any thoughts or comments regarding our conversation. When asked this question, some of the participants said "no" or "not really." Though other participants interviewed did indeed have closing thoughts or comments to share. The following are closing thoughts or comments shared at the conclusion of the interviews.

When asked for her concluding remarks, Sapna shared that she is "thankful for what I have here." Sapna went further to explain that she is "happy that I came here to SI" and that she has "become more environmental friendly and I want to continue to try to make a difference." Sapna hopes that she can "do that one thing that will maybe help someone do something or help the Earth." Sapna concluded that she is "going to be here for awhile, so I might as well make it better."

Dave concluded the interview by discussing how "these patterns, even though you cannot visualize and you cannot see them for yourself, they are happening over time." Dave went further to identify that when thinking about environmental issues, "you need to think more open-mindedly instead of so tunnel vision." Jerome shared Dave's sentiment, and identified that environmental issues "are the things that really need to be

focused on, so that it is what I am focusing on a lot when I'm not busy doing something else." Brian went further than Dave and Jerome to issue a warning regarding environmental issues and their impending impact: "Be prepared. It's in your lifetime."

Maria concluded her interview with discussing how environmental issues are of interest to her and she does not know where this interest originated:

> This kind of thing is really interesting to me. It's sort of my passion. No one in my family is like this and I have other passions too, but it just goes to show that you can do so little and it makes a big difference…Just the little things can make a big difference.

Two of the participants, Samantha and Jawara, discussed the importance of education and knowledge when asked for closing comments. Samantha said that "knowledge is power" and that "if people just understood how bad the environment is and how it could be a lot better and how if it doesn't get better, we are going to be in a lot of trouble." Samantha feels that "if [people] were just more educated on what is really wrong with the environment, they'd be a lot more willing to contribute to helping." Jawara went one step further than Samantha by identifying the need for educators:

> We need more people that are going to talk about [the environment]…let people know that we need to change our lifestyle. We need to save the natural resources. We need more people for that. I would like to have more people go to developing countries and let them know that they are hurting the world because in the developing countries, most of the people are not educated so they don't have this background like the people here in the United States do…In my country, I can say that I have more friends that don't go to school than friends that do go to school. I got more background then they do. If they don't know that they are hurting the Earth, they are going to keep doing it and we will have more impact. If you hurt the Earth, the Earth is going to hurt you back.

When asked for her closing comments, Heidi discussed how "people should keep in mind that it doesn't all have to be bad." Heidi feels as though we need to "keep trying hard and keep pushing through different environmental acts and legislation." Heidi thinks

that “it will eventually work out, it will eventually stick.” Heidi concluded that is important to not focus on the negatives “because I think some people just give up on it when they hear too much.”

In her concluding remarks, Megan made a wish that “we had another planet.” Megan feels as though having another planet “would be really helpful right now…Imagine that we take half the Earth and they go to Venus and then we start living green.” Moving half the Earth would allow us “to fix everything, in a sense.” However, doing so would “destroy another planet along the way.” Megan realizes though that we don’t have another planet, and thus need to work with what we have.

Discussion

When asked to provide closing comments, several of the participants indeed had something to say. For the most part, their closing comments related back to points in which they had discussed earlier in the interview. For example, Jawara shared his wish for the spread of education in his home country to mitigate local environmental issues.

The concept of othering was apparent in some participants closing comments. For example, Dave discussed the need for people to be more open minded when it comes to environmental issues and solutions. Samantha also demonstrated othering through stating that if people were more aware of environmental issues, they would be more willing to help. Finally, some participants, like Brian, offered ominous closing comments by inferring that major environmental and social issues will come to fruition within our lifetimes, and thus must be prepared for them.

Post Program Interviews

Results

Four months post program, participants were again contacted and interviewed (via e-mail) to determine what changes, if any, had been made to their perceptions of sustainability since attending the program. In particular, post program interview questions asked participants what they think about sustainability and environmental issues, if their thoughts on their personal or global futures have changed, if their emotional thoughts about sustainability and environmental issues have changed, if they have learned anything new about sustainability since attending the program, and what they feel is the most important information to cover in a class on sustainability (Appendix H). The following sections thus reflect the results obtained and discussion of the main questions posed to participants.

Four-month Post Program thoughts on Sustainability.

When asked how participants now think about sustainability and environmental issues, a variety of responses were received. In particular, participants mainly spoke of thinking about sustainability and environmental issues about the same as before entering the program or more than before the program. Specifically participants that noted thinking about sustainability and environmental issues about the same before entering the program noted that they either entered the program with greater interest in the topics or participants entered and exited the program with little more interest generated in the topics.

For Dave, the program did not impact him to think more about sustainability or environmental issues because prior to starting the program, he "did care about them a bit more than the average person." However, Dave identified that "prior to the program I had a harsh realistic stance that sustainability was more of a dream than a reality." Though other participants, such as Natalie noted thinking more about sustainability and environmental issues since attending the program:

> I think a little more and I care a little more. Environmental issues are not very much of interest within the area that I live in, so I had little background knowledge of Sustainability upon entering the program, therefore, I didn't think of it as much.

Other participants, like Jiao, noted that because of the program, they "do care more." In response to her increase in caring about sustainability and environmental issues, Jiao translated her caring about sustainability and environmental issues into action by helping her "school start a recycling program." Other actions taken by participants since attending the program include: buying locally grown organic foods, walking to school instead of driving, participating in high school environmental clubs, picking up other's litter, and adjusting life routines in order to live more sustainably.

Post Program thoughts on the Future.

Participants were asked to reflect in what ways, if any, their thoughts on the future have changed since attending the program. None of the responding participants noted that their thoughts on the future have changed since attending the program. However, many of the responding participants noted changes on their thoughts of the future arising from attending the program. Further, most of the participants reflected on their thoughts on the future with regards to their personal futures and not the global future. Samantha

exemplified participants that reflected on how attending SI impacted a change in thoughts of her personal future:

> Before SI, I wanted to be a chemist. I loved chemistry and thought about being a chemical engineer, but then I got to SI and learned more about the environment, sustainability and our affects on them and decided that I wanted to work more with renewable energy, and my chemistry-oriented brain decided that hydrogen power was the best of both worlds.

Some participants, like Josh, noted that he is "not too worried about the future of the world…we'll work things out." Heidi echoed Josh's sentiment, and used a quote from the Bible to illustrate her thoughts on the future: "we shouldn't worry about tomorrow, because tomorrow has enough worries for itself." Though some of the participants, like Jawara, vocalized his concern for the future and relating both his thoughts on his personal and global future:

> …people have to use what they need but not more than they need. And I know it will be a hardship for them to change but that's the only way, change our style of life and make our life simple. In my future I want to be an engineer but I don't know yet on what branch. But I know if I become an engineer I will try to find some ways to make less or no pollution in the atmosphere, use natural fertilize[rs] on the farms etc…[un]Fortunately, with no changes in our life style the world will be just like a desert with no plants, no animals, no people; it will be just dunes of sand on it.

Post Program Emotional Thoughts on Sustainability.

When asked if participants feel differently emotionally about sustainability and environmental issues since finishing SI, most of the responding participants said that they did not. As Liang put it, "I don't think I have different emotions about sustainability other than viewing it with more importance." Though several participants noted emotionally feeling more connected to sustainability and environmental issues. Heidi described,

"Emotionally I feel more connected to the environment. I feel like it's our (humankind's) responsibility to be good stewards of what we've been given." Jiao echoed Heidi's connection by stating that she now feels "more connected to nature."

Post Program knowledge gained in Sustainability.

When asked whether participants have gained new knowledge regarding sustainability or environmental issues since attending the program, the majority of responding participants said they had not. However, Jawara noted that he has gained more knowledge on global warming while Hannah was motivated to become a leader in her school's ecology club, and has learned "about composting and we are looking to use it to dispose of our school's paper towels. We also learned about a town in the Netherlands that is completely sustainable."

What would you cover in a Sustainability class?

I asked participants to tell me what they feel is important to cover in a Sustainability class if they had the option to take one or teach one. A diversity of responses was received, including focusing primarily addressing sustainability from a positive viewpoint, looking at sustainable solutions and ways that students could incorporate sustainability in to their lives.

When asked what she would prefer to cover in a class, Samantha responded that she would "like to learn more about what we, as a race, are…helping to maintain sustainability rather than how we're destroying it." Samantha feels as though if

sustainability was addressed from a more positive vantage point that "people would be more willing to help the cause if it wasn't just a giant blame-session whenever someone talked about the environment."

Jawara expressed interest in learning more about sustainable "solutions and how to apply them." Liang echoes Jawara's interest in learning more about sustainable solutions and "would like to learn more about simple things in which people can change about their life style in order to live more sustainably." Hannah is interested in a class that focused "on the importance of action in the first place." Specifically, Hannah would be interested "in learning more about different government's views and their application of sustainable concepts."

Some participants expressed interest in learning more about scientific aspects of sustainability and environmental problems. To Dave, learning about Fire Ecology was of interest to him because of the "unknown anthropogenic effects of preventing fire." Jiao expressed interest in learning more about specific environmental issues such as "pollution." Heidi expressed interest in a class on Sustainability focusing on learning "more about the natural flow of nature, how humans have disrupted it and what we can do to try to right those wrongs or at least prevent any more destruction."

Discussion

Post program interviews addressed research question seven, which asked if interviewed post-program, have participant's perceptions, knowledge, or outlooks on sustainability or the future changed. As indicated from results obtained, the majority of responding participants had not experienced a change in emotions regarding

sustainability and environmental issues since attending the program. I predict there are several reasons for this: when asked during the program to verbalize their emotions regarding sustainability and environmental issues, some participants had a difficult time. Perhaps the same was true post program, and responding participants simply had a difficult time verbalizing their emotions. Another possibility is that most participants have not experienced a change in emotions regarding sustainability and environmental issues because they have not thought much about them since attending the program. Finally, participants may have misunderstood the question and I could not clarify further because the interviews were conducted over e-mail and not in person.

Although participants demonstrated greater interest in sustainability, the majority of responding participants noted not making gains in their knowledge since attending the program. It is of interest to note that while sustainability and environmental issues were verbalized as important to participants, many have not sought out more knowledge on the topics. There could be several reasons for this: limited access to informational resources, limited time, and limited knowledge of where to find resources. In other words, situational factors may have gotten in the way of participants pursuing greater pro environmental behavior (Hines et al, 1986).

Post program interviews also addressed the subset of research question seven, which asked what do student with an introduction to sustainability feel are the most important means to communicate sustainability to others. As indicated by the results, participants desired for a course in sustainability focused primarily on solutions and actions. The results of their thoughts on a sustainability class is especially pertinent to environmental educators because if we can listen to what participants actually want to

learn about regarding sustainability, perhaps we can help in enacting greater change in their perceived and realized ability to make sustainability a reality.

In summary, the effects of the program and learning about sustainability and environmental issues had varying impacts on participants. For some, attending the program and taking the class on sustainability helped them to define a passion for sustainability and plan to pursue it upon entering college. Though for others, sustainability and environmental issues were of little concern to them. Further, no dramatic differences were observed in participants' responses when looking at during the program or post program. Therefore, I conclude that many responding participants have not modified their views on sustainability and environmental issues since attending the program.

CHAPTER V

CONCLUSION

Overview

This thesis has explored the environmental perceptions of a representative group of the future generation of scientists. Specifically, the thesis focused on the perceptions participants with an aptitude for the sciences have regarding sustainability, the future, and their perceived role within both. The following research questions were addressed through the subsequent themes and other data sources:

Q1: What do students with an aptitude for the sciences perceive as our greatest environmental threats and solutions to said problems?

a. Are differences apparent in perceived environmental threats and solutions between immigrant students versus native students?

Q2: What emotional impacts are associated with internalizing thoughts on environmental issues?

Q3: What do students with an aptitude for the sciences perceive as personal and societal barriers to achieving sustainability?

Q4: How do thoughts on environmental issues impact perceptions of both personal and global futures?

Q5: What role does spirituality/religious beliefs and family influence play in perceptions of environmental issues?

Q6: What are students' major sources of information regarding environmental issues?

Q7: If interviewed post-program, have participants' perceptions, knowledge, or outlooks on sustainability or the future changed?

a. What do students with an introduction to sustainability feel are the most important means to communicate sustainability to others?

Some of the adolescents of today will go on to become the national and global leaders of the future, who will take the lead to address environmental issues and ensure our societies switch to a sustainable paradigm. As history of the environmental movement has shown us, scientists will likely continue to lead the charge in addressing issues harming both human well being as well as mitigating damage on the biotic world. Therefore, in order to better predict the outcome of the future with regards to sustainability and humankind's future, it is critical to understand the perspectives of the future generation of scientists.

As scientists, it is critical that we holistically understand the human dimensions aspect of conservation biology. An example of a relevant conservation biology issue is the reintroduction of species such as the gray wolf into Yellowstone National Park. Biologists can spend years studying the biology of gray wolves in preparation for a reintroduction, though recovery efforts will fail unless public support, cooperation, and participation are garnered in the local community (Jacobsen & McDuff, 1998). Similarly, scientific research on the anthropogenic impacts on the biosphere will not change the outcome of the future unless scientists can achieve public buy-in. Therefore, researchers in the field of conservation biology must take on a critical perspective and task themselves with the responsibility of understanding the human dimensions aspect.

Participants described accurately major global environmental issues that humanity faces. Further, many participants described feasible solutions to assuage environmental

issues. However, a disparity was noted between what participants perceived as solutions to global environmental issues and actions that *they* could undertake or society could undertake to address environmental issues.

As outlined by the Hines Model of Responsible Environmental Behavior (1986), pro environmental attitudes alone are not accurate indicators of pro environmental behaviors. Consistent with previous research (Eagly & Kulesa, 1997; Nerb, Spada, & Wahl, 1998; Stern, 1992), the participants displayed pro environmental attitudes, yet participated in environmentally destructive behaviors. Besides symbolic environmental actions (recycling, picking up litter, etc.), few participants discussed how they actively address environmental issues and promote sustainability through their actions. A common response to actions that could be taken personally or in society to prevent or mitigate environmental issues were "the little things." However, participants never discussed *how* "the little things" work in practice to mitigate environmental issues.

I conclude that there are several reasons that the "little things" predominated in participants minds as pro environmental actions: participants had limited knowledge as to how take pro environmental actions, participants felt that changes within their personal or societal lifestyles are not feasible, and thus, the little things is what they could do, and sources of information taken in by participants (media, school, family, friends, etc.) have told participants that the "little things add up to a big difference", as Maria noted.

In addition to determining what participants perceived as global environmental issues and solutions to said problems, I sought to determine if there was a difference between perceptions of native participants to the United States versus participants that immigrated to the United States. As previously mentioned, four of the 28 participants

hailed from countries outside of the United States and included countries in Africa, China, and India. Of interest to note is that all participants hailing from other countries emigrated from countries considered "less developed" than the United States.

Significant differences between perceptions of environmental issues and solutions were discussed from participants regarding differences between environmental issues in their home countries versus the United States. In particular, for participants originating from China and India, pollution was heavily discussed as environmental issues they encountered while living in their home countries. For Jawara, a participant hailing from a country in West Africa, desertification and lack of education were major drivers of environmental issues.

I conclude that for participants hailing from their home countries, environmental issues were real and tangible, as they had directly impacted them all. In contrast, I conclude that for native participants living mainly in Colorado for most of their lives, global environmental issues were a bit more abstract. Therefore, participants from the United States were able to visualize and discuss environmental issues that they had learned about from various informational sources, yet participants from other countries perceived of environmental issues that they had *directly* encountered. To note, none of the participants described being directly impacted by environmental issues while living in Colorado.

Overall, participants described emotional impacts of internalizing environmental issues using negative terminology. In particular, terms such as crappy, frustrating, and disappointed predominated in the minds of participants. I expected participants to demonstrate overall negative emotions to internalizing environmental issues, but was

surprised at the overwhelmingly negative response. I conclude that although rarely talked about in their daily lives, participants held negative views of environmental issues, which may have led some of them to express pessimistic predictions of the future.

When asked what participants perceived as personal and societal barriers to taking action to prevent or mitigate environmental issues, the majority of participants discussed shortcomings in human behavior. Common responses included that humans are lazy, short sighted, and greedy. However, it is of interest to note that none of the participants noted lack of action tools as personal and societal barriers to addressing environmental issues. In addition, the concept of *othering* was readily apparent among participants, as barriers to environmental action were addressed regarding societies problems and not personal problems. Originating as a philosophical then feminist term, othering implies inclusion of some into a group and exclusion of others (Canales, 2000). In other words, othering allows for an avenue with which blame or marginalization can be diffused. To go further, many of the participants in the post program interviews suggested that a class on sustainability focusing on how one could take action was heavily discussed. Therefore, I conclude that a disparity exists between how participants vocalized what they perceived as personal and societal barriers to environmental action, and what they would find important to learn about regarding sustainability and environmental issues.

As discussed previously, participants' perceptions of both their personal and global futures showed little overlap. In some instances, participants discussed that if the future of the environment is not good, then their personal futures will not be good. Therefore, some participants understood the connection between their personal lives and the future of the world. However, many participants demonstrated a disconnection

between their thoughts on the global future verses their thoughts of their personal futures. For example, some participants demonstrated pessimistic perceptions of environmental issues and the future, yet demonstrated positive perceptions of their personal futures. Therefore, a disconnect was evident for many participants as they held conflicting personal and global views of the future.

With regards to the role of religious/spiritual beliefs on perceptions of environmental issues, only several participants noted a connection. Many stated that there was not a connection because they either identified as not religious or spiritual or because they had never thought of their religious/spiritual beliefs in relation to environmental issues. However, many participants that identified as holding religious/spiritual beliefs indeed noted a connection to their thoughts on environmental issues. Indeed, many participants noted general notions aligning with their designated religious/spiritual beliefs (for example, a stewardship concept). Therefore, the findings of this study disproportionately aligned with studies (Wolkomir et al, 1997) demonstrating that religious saliency can indeed positively impact pro environmental sentiment.

Further, many participants assumed that they aligned or did not align with their parents/families on environmental issues, but were unsure because environmental issues were topics that "rarely made dinner table discussion" as Josh noted. Therefore, I conclude that topics revolving around environmental issues and sustainability rarely came up in family conversations and were thus indicative of low conversation value. However, for those that did indicate alignment with parents/families on opinions regarding environmental issues, there was not a clear indication of pro environmental sentiment.

In alignment with previous studies, participants noted sources such as school, news, Internet, and media among major sources of information regarding environmental issues and sustainability. Interestingly, of the 28 participants, only several identified that they had previous educational background in sustainability or environmental issues prior to attending the program. Therefore, I conclude that much of the informational sources utilized by participants laid outside of a formal educational setting, such as media, news, and Internet. However, of the participants that identified having previous educational experience in environmental issues and sustainability demonstrated overall pro environmental sentiment. My findings thus support the Hines Model of Responsible Environmental Behavior (1986) in that knowledge of environmental issues is a predictor and foundation to an individual demonstrating pro environmental behavior.

Of the participants responding to the post program interview, few noted changes in their knowledge, attitudes, or perceptions of sustainability, environmental issues, or the future. However, some of the responding participants did note changes in their behaviors. For some participants, like Hannah, knowledge gained through the summer program piqued her interest to become involved with her school's environmental club. Therefore, I conclude that despite participants demonstrating environmental concern during the program, many of the participants had not grown in their knowledge, attitudes, or behavior, since attending the program.

Implications

Unlike science, mathematics, and literacy curriculum, environmental education has not been introduced as a fundamental and foundational curriculum in many parts of

the United States. Therefore, a great majority of United States citizens are going through formal schooling with little learning on topics on sustainability and environmental issues. Because of this, we are developing a future generation of leaders and policy makers that are more or less unaware of the basis for environmental issues and sustainability from formal educational settings and will instead rely upon other informational sources such as news and media to gain their knowledge, and thus form their attitudes, on environmental issues and sustainability.

As we have learned in this heated time of politics, issues revolving around the environment become polarized along party lines and are thus more or less emphasized depending on who is in power. If we wish to move away from this track in which environmental issues, sustainability, and our future become topics encountered only on ballots every several years in November, policy makers and leaders in education must take the charge in implementing holistic environmental education throughout the entire K-12 and higher education curriculum.

To go further, environmental education in its current state may not be as encompassing as necessary to holistically address environmental issues, sustainability, and the future. In recent years, a shift to education for sustainable development from environmental education has been promoted. In particular, education for sustainable development places value on not only environmental awareness and protection, but also views environmental problems from the wider context of sustainable development and promotes changes to both socio-economic processes and people's lifestyles (Winter, 2008).

The implications found in this thesis are noteworthy. Of legitimate concern to both educators and the general public is the overall pessimistic outlook participants demonstrated regarding the future. The results of this study are consistent with other findings (Hutchinson, 1996) in that a pessimistic outlook on both the environment and the future are becoming commonplace. Logically, people who are pessimistic about the future may be more likely to enter into anticipatory despair (Jurin, 2006), thus causing a decrease in motivation to actively address environmental issues. Therefore, it should be of great concern to educators and the general public alike to learn how to discuss in realistic terms the impending future of environmental issues and sustainability, though at the same time provide positive encouragement and tools of empowerment to make a switch to a sustainable paradigm a reality. Therefore, environmental action competency is a critical piece of education for sustainable development that must be implemented at all levels of environmental knowledge.

Recommendations

The following are recommendations that could expand the work conducted in this thesis:

1. A disparity was noted between actions perceived that participants could take verses actions actually taken. It would be of value to determine exactly what actions participants currently take to mitigate environmental issues in their daily lives. If actions are taken by participants, to what end do participants perceive of themselves "making a difference"?
2. Expand the sample population to include a greater variety of participants. For the present study, it was of value to determine the environmental perceptions of students with an aptitude for the sciences, as I had access to the sample population. However, it would

be of interest to research the environmental perceptions of a greater cross section of adolescents. Specifically, participants researched in the present study could be described as high achieving, scientifically minded students. Future studies could draw comparisons from other groups of young adults, including students of average achievement and moderate interest in the sciences and high-risk students.

3. Within a group studied, utilize multiple data collection techniques. If working with a similar extra-curricular extended program, it may be beneficial to adopt a methodology that could utilize both multiple in-depth, semi-structured interviews as well as focus groups (Merriam, 1998) to broaden the perspectives that arise from individual conversation verses group dynamics. Finally, it would be of interest to note the changes made to participant's viewpoints throughout attending a program by emphasizing participant maintained notebooks in which participants could on a regular basis practice self reflexivity (Merriam, 1998).

4. In the present study, I did not attempt to quantify the knowledge gains of participants regarding their knowledge in Sustainability and environmental issues. The reason for this is that instead, I took an exploratory case study approach to understanding the participants' environmental perceptions and worldviews. A future study could take a different theoretical perspective, such as critical inquiry, and seek to actively modify the participants' knowledge, attitudes, and behaviors.

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APPENDIX A

Institutional Review Board Approval

STUDENT'S COPY

UNIVERSITY of NORTHERN COLORADO
Institutional Review Board (IRB)

April 13, 2010

TO: Teresa McDevitt
School of Psychological Sciences

FROM: Megan Babkes Stellino, Co-Chair
UNC Institutional Review Board

RE: Expedited Review of Proposal, *Enhancing the Human Dimensions Aspect of Conservation Biology, Ecology and Sustainability,* submitted by Abby Davidson (Research Advisor: Richard Jurin)

First Consultant: The above proposal is being submitted to you for an expedited review. Please review the proposal in light of the Committee's charge and direct requests for changes directly to the researcher or researcher's advisor. If you have any unresolved concerns, please contact Megan Babkes Stellino, School of Sport and Exercise Science, Campus Box 39, (x1809). When you are ready to recommend approval, sign this form and return to me.

I recommend approval as is/modified: Teresa McDevitt April 14, 2010
Signature of First Consultant Date

The above referenced prospectus has been reviewed for compliance with HHS guidelines for ethical principles in human subjects research. The decision of the Institutional Review Board is that the project is approved as proposed for a period of one year: April 22, 2010 to April 22, 2011

Megan B Stellino 4/22/2010
Megan Babkes Stellino, Co-Chair Date

Comments: corrections to consent forms, clarifications on procedures for handling data. Teresa McDevitt

APPENDIX B

Participant Consent and Assent Forms

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH - UNIVERSITY OF NORTHERN COLORADO (for students to sign if over the age of 18)

Project Title: Enhancing the Human Dimensions Aspect of Conservation Biology, Ecology and Sustainability

Researcher: Abby Davidson, Master's candidate, Department of Biological Sciences
Phone: 970 397 7755 E-mail: rouk1592@bears.unco.edu

Research Advisor: Richard Jurin, PhD, Associate Professor, Department of Biological Sciences
Phone: 970 351 2220 E-mail: Richard.Jurin@unco.edu

Hello!

My name is Abby and I am your Biology instructor for the Frontiers of Science Institute. I am also a Biology Graduate student at the University of Northern Colorado. For my Thesis research, I am focusing on enhancing the human dimensions aspect of Conservation Biology, Ecology and Sustainability. My thesis research will be conducted by designing and implementing the FSI Biology curriculum, which will focus on understanding how the previously mentioned fields interact.

In order to conduct the research, you will be assessed of your knowledge and perceptions of topics and issues within the fields of Conservation Biology, Ecology and Sustainability. Rest assured that the information I collect will not reflect on you in any negative way, but is rather for me to develop a greater understanding of your knowledge and perspectives. Furthermore, you do not need to study for the assessment or prepare in any other way. In addition, I may interview you at some points during the program for the purpose of developing a greater understanding of your perspective of topics and issues within the previously mentioned fields. Approximately 3 interviews will be conducted lasting 30 minutes and will be recorded to back up notes taken. Recordings will be transcribed at the earliest convenience and will be destroyed within a period of 3 years. Again, rest assured that I intend to keep both the contents of the interviews and your identity confidential. In order to maintain confidentiality, you will be given the opportunity to create a pseudonym you would like to be referred to. To further maintain your confidentiality, only your pseudonym will be used in professional reports preceding the interviews.

Thanks for your participation and I look forward to an exciting and engaging summer exploring the sciences with you!

Sincerely,

Abby J. Davidson

Participation is voluntary. Having read the above information, you may decide not to participate in this study. Your decision will be respected and will not have any negative implications. Having read the above information and having had an opportunity to ask any questions, please print your name and sign below if you would like to participate in this research. If you have any concerns about your selection or treatment as a research participant, please contact the Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970 351 2161.

_____

Student's Name (Print)

_____

Student's Signature Date

ASSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH - UNIVERSITY OF NORTHERN COLORADO (for students to sign if under the age of 18)

Project Title: Enhancing the Human Dimensions Aspect of Conservation Biology, Ecology and Sustainability

Researcher: Abby Davidson, Master's candidate, Department of Biological Sciences
Phone: 970 397 7755 E-mail: rouk1592@bears.unco.edu

Research Advisor: Richard Jurin, PhD, Associate Professor, Department of Biological Sciences
Phone: 970 351 2220 E-mail: Richard.Jurin@unco.edu

Hello!

My name is Abby and I am your Biology instructor for the Frontiers of Science Institute. I am also a Biology Graduate student at the University of Northern Colorado. For my Thesis research, I am focusing on enhancing the human dimensions aspect of Conservation Biology, Ecology and Sustainability. My thesis research will be conducted by designing and implementing the FSI Biology curriculum, which will focus on understanding how the previously mentioned fields interact.

In order to conduct the research, you will be assessed of your knowledge and perceptions of topics and issues within the fields of Conservation Biology, Ecology and Sustainability. Rest assured that the information I collect will not reflect on you in any negative way, but is rather for me to develop a greater understanding of your knowledge and perspectives. Furthermore, you do not need to study for the assessment or prepare in any other way. In addition, I may interview you at some points during the program for the purpose of developing a greater understanding of your perspective of topics and issues within the previously mentioned fields. Approximately 3 interviews will be conducted lasting 30 minutes and will be recorded to back up notes taken. Recordings will be transcribed at the earliest convenience and will be destroyed within a period of 3 years. Again, rest assured that I intend to keep both the contents of the interviews and your identity confidential. In order to maintain confidentiality, you will be given the opportunity to create a pseudonym you would like to be referred to. To further maintain your confidentiality, only your pseudonym will be used in professional reports preceding the interviews.

Thanks for your participation and I look forward to an exciting and engaging summer exploring the sciences with you!

Sincerely,

Abby J. Davidson

Participation is voluntary. Having read the above information, you may decide not to participate in this study. Your decision will be respected and will not have any negative implications. Having read the above information and having had an opportunity to ask any questions, please print your name and sign below if you would like to participate in this research. If you have any concerns about your selection or treatment as a research participant, please contact the Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970 351 2161.

_____

Student's Name (Print)

_____

Student's Signature Date

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH - UNIVERSITY OF NORTHERN COLORADO (for parents to sign if participant under the age of 18)

Project Title: Enhancing the Human Dimensions Aspect of Conservation Biology, Ecology and Sustainability

Researcher: Abby Davidson, Master's candidate, Department of Biological Sciences
Phone: 970 397 7755 E-mail: rouk1592@bears.unco.edu

Research Advisor: Richard Jurin, PhD, Associate Professor, Department of Biological Sciences
Phone: 970 351 2220 E-mail: Richard.Jurin@unco.edu

Hello,

My name is Abby and I am the Biology Instructor for the Frontiers of Science Institute (FSI). I am also a Graduate student in Biology at the University of Northern Colorado. My thesis research focuses on enhancing the human dimensions aspect of Conservation Biology, Ecology and Sustainability. The research will be conducted by designing and implementing the FSI Biology curriculum, which will focus on the intersection of the previously mentioned fields.

In order to do conduct the research, your student will be assessed on their knowledge and perceptions towards varying topics and issues within the fields of Conservation Biology, Ecology and Sustainability. Rest assured that the results of the assessments will not reflect on your student in any negative way and will only be used for analysis procedures to be used towards my Thesis research. Furthermore, all students will participate in both assessments and surveys (for instructional purposes). Therefore, I request permission to use the results for data analysis to be used in my Thesis research.

A sampling of the students participating in FSI will be interviewed to develop a greater understanding of their attitudes and perceptions towards topics and issues within the fields of Conservation Biology, Ecology and Sustainability. Approximately 3 interviews lasting 30 minutes will be conducted and recorded to back up the notes taken. Recordings will be transcribed at the earliest convenience and will be destroyed within a period of 3 years. Be assured that efforts will be made to maintain confidentiality of students. In order to maintain confidentiality, your student will be given the opportunity to create a pseudonym they would like to be referred to. To further maintain their confidentiality, only the student's created pseudonym will be used in professional reports preceding the interviews.

Please feel free to phone me if you have any questions or concerns about this research and please retain one copy of this letter for your records. Thank you for assisting me with my research and I look forward to a great summer!

Sincerely, Abby J. Davidson

Participation is voluntary. Having read the above information, you may decide not to allow your student to participate in this study. Your decision will be respected and will not have any negative implications. Having read the above information and having had an opportunity to ask any questions, please sign below if you will allow your student to participate in this research. If you have any concerns about your student's selection or treatment as a research participant, please contact the Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970 351 2161.

_____
Student's Name (Print)

_____
Legal Guardian's Signature Date

APPENDIX C

Institutional Review Board Addendum Approval

Request for IRB Change

Submit this request and all attachments to Sherry May, IRB Administrator, Office of Sponsored Programs, Kepner Hall, Suite #25

STUDENT'S COPY

UNIVERSITY of NORTHERN COLORADO

Date of Original UNC IRB Approval: 4/22/2010

Project Title: (Formerly) Enhancing the Human Dimensions Aspect of Conservation Biology, Ecology, and Sustainability)
(currently) Sustainability and the Future: A Case study on Environmental Perspectives of the Future Generation of Scientists

Lead Investigator
Name: Abby Davidson
School: Biological Sciences
Email: Abby.Davidson@unco.edu
Phone: 970.397.7755

Research Advisor (if applicable)
Name: Richard Jurin
School: Biological Sciences
Email: Richard.Jurin@unco.edu
Phone: 970-351-2220

On a separate page, describe and provide justification for the changes being proposed. Be concise and specific in describing methodological changes that affect the experience of participants and/or relate to the risks/benefits of participation. Explain why these changes are necessary.

○ Yes ◉ No The proposed changes in protocol will necessitate changes in documents such as recruitment flyers, consent forms, debriefing forms, or other project-related documents.

○ Yes ◉ No If yes, copies of the revised documents with changes highlighted are attached to this request.

CERTIFICATION OF LEAD INVESTIGATOR
I certify that information contained in this request is complete and accurate.

Signature of Lead Investigator [signature] Date 11/1/10

CERTIFICATION OF RESEARCH ADVISOR (If Lead Investigator is a Student)
I certify that information contained in this request is complete and accurate.

Signature of Research Advisor [signature] Date 11/1/10.

Approved by: [signature] 11/7/10

Chairperson, Institutional Review Board Date

SPONSORED PROGRAMS NOV 02 2010

Clear Form Date Request Received by OSP: _____

APPENDIX D

Pre and Post Program Open Ended Questions

Pre Program Open Ended Questions

For each of the following open-ended questions, provide a 3-5-sentence response. Remember, there is no right or wrong answer – just describe what you think.
Note: Please write legibly!

1. Describe what Ecology is and what it means to you.

2. Describe what Conservation Biology is and what it means to you.

3. Describe what Sustainability is and what it means to you.

4. In what ways do you think that humans impact the environment?

5. Describe some global issues that you feel humanity faces.

6. What are some potential solutions to the global issues mentioned in question 5?

Post Program Open Ended Questions

For each of the following open-ended questions, provide a 3-5-sentence response. Remember, there is no right or wrong answer – just describe what you think.
Note: Please write legibly!

1. Given your newfound knowledge of Sustainability, describe in 3-5 sentences what Sustainability is.

2. In 3-5 sentences, describe some of the major global issues humanity faces relating to Sustainability.

3. In 3-5 sentences, describe what you think we should do to resolve local and global environmental issues to reach a sustainable future.

APPENDIX E

New Ecological Paradigm Survey and Results

Listed below are statements about the relationship between humans and the environment. For each, please indicate whether you STRONGLY AGREE (SA), MILDLY AGREE (MA), UNSURE (U), MILDLY DISAGREE (MD), or STRONGLY DISAGREE (SD) with the statement.

1. We are approaching the limit of the number of people the earth can support.
SA MA U MD SD

2. Humans have the right to modify (change) the natural environment to suit their needs.
SA MA U MD SD

3. When humans interfere with nature it often produces disastrous consequences.
SA MA U MD SD

4. Human ingenuity (cleverness) will insure that we do NOT make the earth unlivable.
SA MA U MD SD

5. Humans are severely abusing the environment.
SA MA U MD SD

6. The earth has plenty of natural resources if we just learn how to develop them.
SA MA U MD SD

7. Plants and animals have as much right as humans to exist.
SA MA U MD SD

8. The balance of nature is strong enough to cope with the impacts of modern society.
SA MA U MD SD

9. Despite our special abilities humans are still subject to the laws of nature.
SA MA U MD SD

10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.
SA MA U MD SD

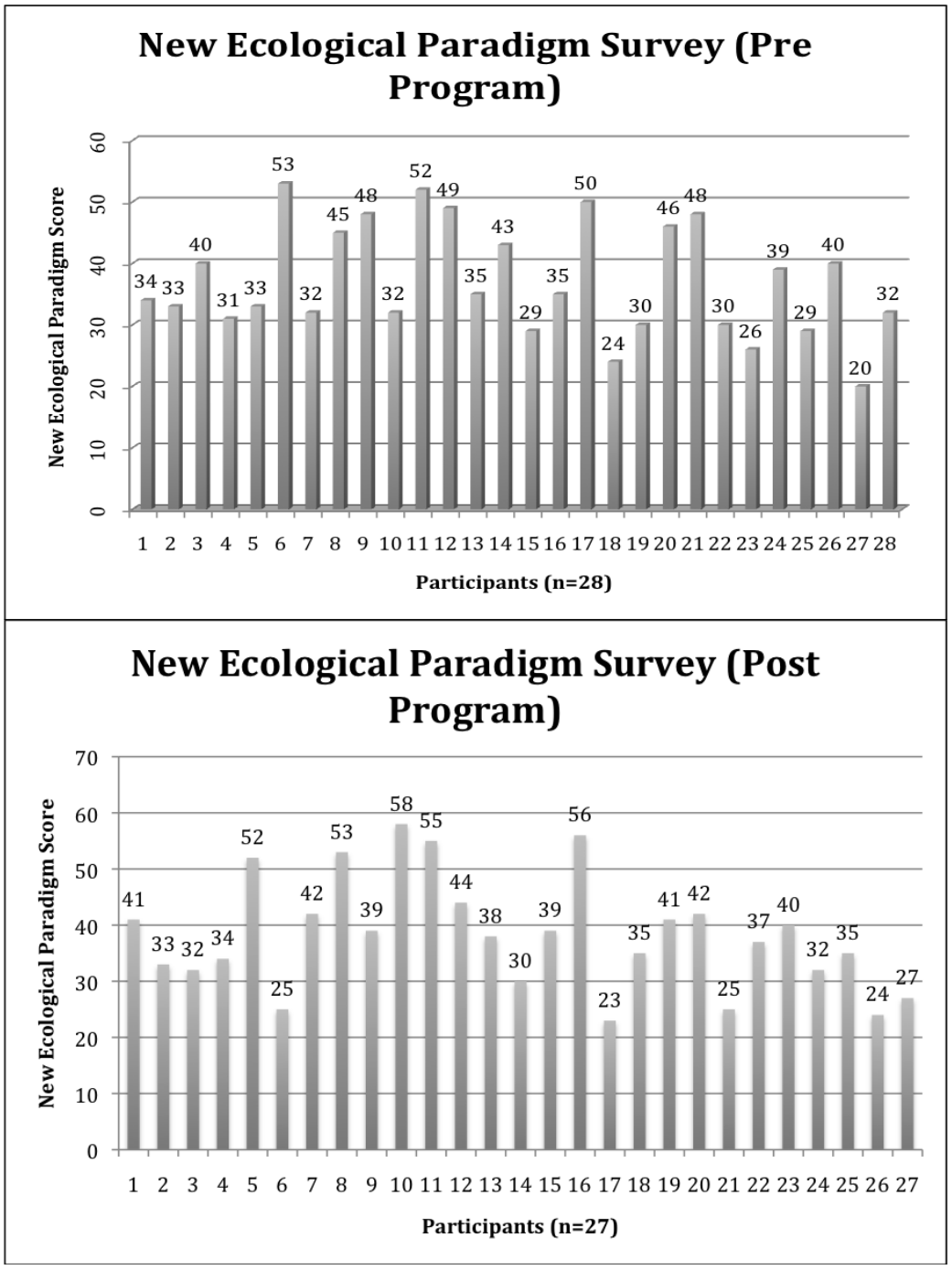
11. The earth is like a spaceship with very limited room and resources.
SA MA U MD SD

12. Humans were meant to rule over the rest of nature.
SA MA U MD SD

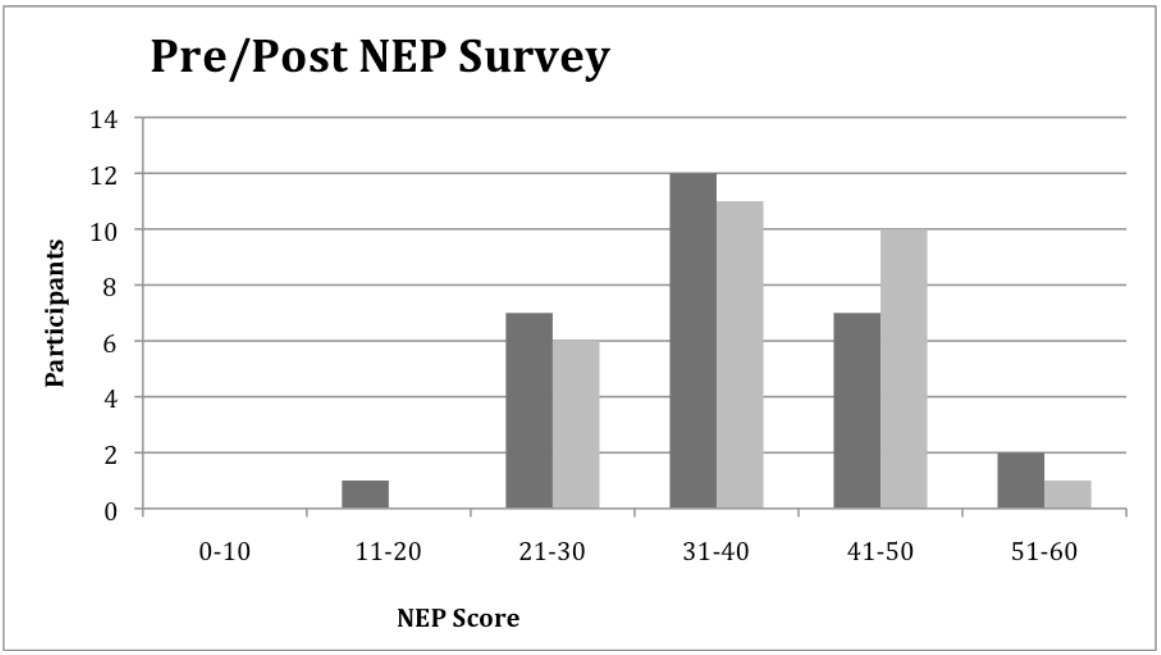
13. The balance of nature is very delicate and easily upset.
SA MA U MD SD

14. Humans will eventually learn enough about how nature works to be able to control it.
SA MA U MD SD

15. If things continue on their present course, we will soon experience a major ecological catastrophe.
SA MA U MD SD



Note: The participant numbers 1-28 and 1-27 do not match any specific participant.



*Black columns indicate grouped pre program scores while gray columns indicate grouped post program scores

APPENDIX F

Program Interview Questions

Interview Questions:

1. Please discuss briefly what you think our greatest environmental issues are that society faces and why you think they are such a threat.

2. What types of actions do you currently take to prevent or reduce these major environmental problems?

3. What actions do you feel you could take to reduce or prevent these environmental problems?

4. Who should be responsible for fixing our greatest environmental problems?

5. What role do you feel your spirituality plays in your thoughts about the future with regards to environmental issues?

6. How do you think that you could incorporate these previously mentioned environmental concerns into your future career?

7. Where have you learned about these environmental issues?

8. Have you had any teachers or other role models that have influenced your perceptions of environmental issues?

9. What role does your parents' beliefs in the future in terms of environmental issues play in your beliefs?

10. Do you feel that you and your parents' beliefs about the future in terms of environmental issues are the same (aligned) or different? Also, how often do you discuss environmental issues with your parents/family?

11. Why do you think that we don't stop everything we are doing and fix our big environmental issues? What is stopping us as a society?

12. Let's imagine that tonight, you fall asleep and do not wake up again until 50 years later. Please describe what you visualize? (good or bad).

13. How do you feel that our environmental problems relate to science?

14. What do you feel is the future of society?

15. What types of changes (if any) do you feel could be made in our society and culture to prevent or reduce environmental impacts?

16. What type of responsibility do you feel towards your future children (future generations) to prevent or reduce environmental issues?

17. Has the course in sustainability or the program in general influenced you in any way or expanded your knowledge of environmental issues?

18. How does thinking about environmental issues impact you emotionally? Do you feel anxiety? Do you try not to think about them?

19. What makes you think about environmental issues?

20. Do you ever feel cheated by previous generations in terms of the major environmental problems caused by them?

21. How do you envision happiness?

22. How do you envision your future?

APPENDIX G

Career Goals Assignment

FSI 2010 - Your Career Goals & Your Life Goals

Life Goals

1. If you had a whole year to do what you always dreamed of doing, list three things you would do (no limits on money, time, etc.):

a. _____
b. _____
c. _____

2. List at least 5 of your life goals (e.g. travel to Rome, win the Nobel prize, fall in love):

a. _____
b. _____
c. _____
d. _____
e. _____

Looking at the extreme cases below, consider what is more important to you when choosing career:

a. Top Priority: Making as much money as possible
b. Top Priority: Waking up every morning and enjoying going to work each day

If your ideals fall somewhere in between these extreme cases, explain below:

Career Goals

1. Select what you consider to be your favorite possibility for a career goal:

_____

2. List at least three specific reasons why this is your favorite choice:

a. _____
b. _____
c. _____

3. Does this career goal fall in line with your life goals? Does this matter to you?

4. Just because we always need a plan B, list at least three other possible career choices and what attracts you to them

a. _____
b. _____
c. _____

5. Obtain the following information about your career goal

* Some of these questions you can already answer, however, you may have to use other resources to answer the remainder*

a. What particular life skills are needed?
b. What high school/college courses would be most suited to achieving your goal and may help you decide if this is really what you want to do?

c. What experience (e.g. internships, volunteer work, shadowing, etc.) would help you to decide if this is really what you want to do?

d. What is the minimum amount of years of schooling required to attain your goal (e.g. undergraduate, graduate (Masters/PhD), and professional (medical, veterinary)?

e. What is the future employment outlook? Is the field getting "flooded" with graduates in the area? Will there always be a high demand for this type of job?

f. What is the starting salary?

g. What are the opportunities for advancement?

h. Will much of your job task involve working alone or will much of it involve interacting with other workers? What is your strong suit? Are you a team player or do you work better alone?

i. Will this job allow you a lot of flexibility once you become established? If having a family is important to you, will you career choice allow you very much time with your family?

j. Are there any aspects of this career that you might find undesirable?

k. Does this career require a large amount of public speaking/presentations? Are you comfortable with this, if it does?

l. Are there any scholarship or foundation monies available for financial grants? If so, list as many as possible below.

6. Interview a person who is working in the career you are interested in. The following questions are suggested as a guide for your interviewing. You should brainstorm other questions and record all answers on a sheet of paper. Be sure that you ask the interviewee if they mind you recording their answers before beginning the interview.

a. At what age did you first think that you might be interested in your chosen career?
b. What are some personal factors that influenced your decision to choose this career?
c. What other people, if any, had an influence on your choice of career?
d. Do you ever regret choosing the career that you did?
e. What other careers, if any, do you think you would have been happy in?
f. Could you list three positive aspects of your career choice?
g. Could you list three negative aspects of your career choice?

7. On a separate piece of paper (it could be the back of this paper), summarize your feelings as a result of interviewing an actual person working in the field of your chosen career.

*Has this changed your views about your career goal? How?

*Has this supported your career choice? How?

APPENDIX H

Post Program Interview Questions

1. Write a reflection (how short or as long as you want) regarding your experiences of FSI and in what ways it impacted you (if any). If you would feel more comfortable expressing your thoughts through a way other than typing words (i.e. drawing, music, etc.), please let me know and I can give you an address to send me stuff.

2. Now that you have had an introduction to sustainability and some of the environmental issues that we face, what do you think of them (i.e. do you think more often about them, do you think less, do you care more, do you care less)?

3. How do you describe your thoughts on the future since we last talked (i.e. future career choice, how you think of the future of the world, etc.)?

4. In what ways (if any) do you feel any different emotionally about sustainability and environmental issues since we last talked?

5. What new things have you learned (if anything) about sustainability or environmental issues (i.e. new problems, new solutions, etc.)?

6. If you had the option of taking a class on sustainability, what do you think would be the most important information to cover or what would you most want to learn about?

7. Please share any closing thoughts that you have regarding any of the questions I have asked you, either from this e-mail or from the previous interview.

APPENDIX I

Reflection Assignments

Rocky Mountain National Park quote and reflection:

"Each year, thousands of acres of wildlife habitat are lost to development in Colorado. The area equivalent in size to Morraine Park is lost almost weekly. What do you think this view would look like if it were not part of a National Park? What do you think it will look like in 50 years?"

Thinking Like a Mountain by Aldo Leopold

"A deep chesty bawl echoes from rimrock to rimrock, rolls down the mountain, and fades into the far blackness of the night. It is an outburst of wild defiant sorrow, and of contempt for all the adversities of the world.

Every living thing (and perhaps many a dead one as well) pays heed to that call. To the deer it is a reminder of the way of all flesh, to the pine a forecast of midnight scuffles and of blood upon the snow, to the coyote a promise of gleanings to come, to the cowman a threat of red ink at the bank, to the hunter a challenge of fang against bullet. Yet behind these obvious and immediate hopes and fears there lies a deeper meaning, known only to the mountain itself. Only the mountain has lived long enough to listen objectively to the howl of a wolf.

Those unable to decipher the hidden meaning know nevertheless, that it is there, for it is felt in all wolf country, and distinguishes that country from all other land. It tingles in the spine of all who hear wolves by night, or who scan their tracks by day. Even without sight or sound of wolf, it is implicit in a hundred small events: the midnight whinny of a pack horse, the rattle of rolling rocks, the bound of a fleeing deer, the way shadows lie under the spruces. Only the ineducable tyro can fail to sense the presence or absence of wolves, or the fact that mountains have a secret opinion about them.

My own conviction of this score dates from the day I saw a wolf die. We were eating lunch on a high rimrock, at the foot of which a turbulent river elbowed its way. We saw what we thought was a doe fording the torrent, her breast awash in white water. When she climbed the bank toward us and shook out her tail, we realized our error: it was a wolf. A half-dozen others, evidently grown pups, sprang from the willows and all joined in a welcoming melee of wagging tails and playful maulings. What was literally a pile of wolves writhed and tumbled in the center of an open flat at the foot of our rimrock.

In those days we had never heard of passing up a chance to kill a wolf. In a second we were pumping lead into the pack, but with more excitement than accuracy: how to aim a steep downhill shot is always confusing. When our rifles were empty, the old wolf was down, and a pup was dragging a leg into impassable slide-rocks.

We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes--something known only to her
and to the mountain. I was young then, and full of trigger-itch; I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise. But after seeing the green fire die, I sensed that neither the wolf, nor the mountain agreed with such a view.

Since then I have lived to see state after state extirpate its wolves. I have watched the face of many a newly wolfless mountain, and seen the south-facing slopes wrinkle with a maze of new deer trails. I have seen every edible bush and seedling browsed, first to anemic desuetude, and then to death. I have seen every edible tree defoliated to the height of a saddle horn. Such a mountain looks as if someone had given God new pruning shears, and forbidden Him all other exercise. In the end, the starved bones of the hoped-for deer herd, dead of its own too-much, bleach with the bones of the dead sage, or molder under the high-lined
junipers.

I now suspect that just as a deer herd lives in mortal fear of its wolves, so
does a mountain live in mortal fear of its deer. And perhaps with better cause, for while a buck pulled down by wolves can be replaced in two or three years, a range pulled down by too many deer may fail of replacement in as many decades.

We all strive for safety, prosperity, comfort, long life, and dullness. The deer strives with his supple legs, the cowman with trap and poison, the statesman with pen, the most of us with machines, votes, and dollars, but it all comes to the same thing: peace in our time. A measure of success in this is all well enough, and perhaps is a requisite to objective thinking but too much safety seems to yield only danger in the long run.

Perhaps this is behind Thoreau's dictum: In wildness is the salvation of the world. Perhaps this is the hidden meaning in the howl of the wolf, long known among mountains, but seldom perceived among men."

Carrying Capacity of Elk Herds in Rocky Mountain National Park

History: North American Elk (wapiti) were historically plentiful in the Rocky Mountain area. However, due to intensive hunting during the late 1800's, nearly all elk were extirpated from the area. In 1913, 49 elk from Yellowstone National Park were re-introduced into Rocky Mountain National Park. Historical predators such as the Gray Wolf and the Grizzly Bear were eliminated from the park, allowing for the elk population to increase.

Currently, the elk herds of Rocky Mountain National Park have become overpopulated, resulting in intensive damage to the landscape from overconsumption of the plants. Several strategies have been implemented to reduce the numbers of elk in the park, including culling (other word for hunting), sterilization, birth control, and relocation.

There has even been talk of re-introducing wolves into the park for the purpose of reducing numbers.

In your journals, write at least a ½ page reflection on the short story Thinking Like a Mountain, relating it to the current problem of elk overpopulation in Rocky Mountain National Park.