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Nurturing Environmental Literacy at Colby College: Higher Education and the Environmental Crisis

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Table of Contents

Abstract

The environmental crisis will affect all people, career paths, and academic disciplines. Acknowledging this, does higher education have an obligation to educate all students for environmental literacy (EL)? This study reviews literature on how to effectively assess and implement EL initiatives and highlights how other colleges successfully nurture EL in all students. This study also uses quantitative and qualitative survey measures to understand student levels of EL at Colby College and to highlight specific programming or curriculum that leads to high EL levels in students. Findings include significantly different EL scores between environmental studies student respondents and respondents in all other disciplines. A combination of findings from the literature, analyses of quantitative survey results, and qualitative student responses inform the suggestions for Colby College presented in this research.

Introduction

Humans are facing a crisis of a never before seen magnitude. Entire countries, species, and biomes are threatened. Undeniable changes on Earth such as receding glaciers, species extinction, ozone depletion, and ocean acidification are already outcomes of the crisis. Global climate change is not just a threat; it is a crisis that has already altered ecological systems all over the earth and shows no sign of stopping. Reports from the EPA estimate that one out of every four species on earth will be extinct within the next 100 years. Anyone who's taken high school biology can fathom the extraordinary devastation that would occur if the earth were to loose 25% of species. Global climate change is happening at a high speed and immediate action is necessary to ensure the vitality of our species. Leaders, organizations, or governments that fail to accept these facts and take action are doing a disservice to the planet and all of its inhabitants.

We desperately need leaders who understand natural systems, how humans affect these systems, and recognize the complicated interactions between the economy, culture, and ecology. Unfortunately, the status quo of mainstream education does not educate leaders for these tasks. If it did, we would not be facing such extreme environmental problems. As David Orr states in his book, *Earth in Mind*,

> "Those now being educated will have to do what we, the present generation, have been unable or unwilling to do: stabilize world population; stabilize and then reduce the emission of green house gases, which threaten to change the climate, perhaps disastrously; protect biological diversity; reverse the destruction of forests everywhere; and conserve soils. They must learn how to use energy and material with great efficiency. They must learn how to utilize solar energy in all of its forms. They must rebuild the economy in order to eliminate waste and pollution. They must learn how to manage renewable resources for the long run. They must begin the great work of repairing as much as

> possible, the damage done to the earth in the past 200 years of industrialization. And they must do all of this while they reduce worsening social and racial inequalities. No generation has ever faced a more daunting agenda," (p. 26-27).

The magnitude of these tasks, again, cannot be understated. Furthermore, nothing will change if the next generation is educated in the same manner as past generations. The crucial nature of these tasks begs the question, why aren't all students leaving school with some level of "environmental literacy"?

The ultimate goal of environmental education should be to create environmentally literate citizens (NAAEE, 2011). "Environmental literacy" (EL) is a term coined by Charles Roth in 1968 as a response to the environmentally *illiterate* people and industries that were polluting the environment. Roth (1992) frames EL in terms of a person's environmental knowledge, skills, affects, and behavior. According to Roth, an environmentally *literate* person is someone who understands the interrelatedness of all living things, recognizes environmental problems, feels an obligation to sustain the earth and regularly takes action to do so.

Fortunately, environmental education has found a place in an increasing number of k-12 curriculums over the last decade. Whether squeezed into after school programs, science curriculums, summer sessions, supplemental school programming, or actually crafted as its own discipline, environmental education is crucial to developing relationships between children and the environment at a young age. No matter what path, academic discipline, or career students end up choosing, they affect the environment and the environment affects them. No person or discipline is removed from climate change, and thus, everyone should receive an education that provides him or her with the skills to interact with the environment in a healthy and conscious manner.

The EPA (2015) defines environmental education as "a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment." The goals within this definition may seem lofty for a mainstream classroom to achieve, but it is important to reiterate that every decision a person makes or action a person takes affects the environment. Thus, environmental problem solving in a classroom can take the shape of simple initiatives like washing and re-using sandwich bags after lunch. Practicing this type of problem solving combined with action allows students to think about the environment as something they constantly interact with, rather than some intangible problem in the Amazon.

Environmental education is critical for all types of schools and ages of students. The next generation has a litany of tasks ahead of it that will only intensify by failing to incorporate environmental literacy as a mainstream curricular outcome. Educating the general public about the environment is critical.

That being said, we not only need an educated citizenry, but also a generation of global leaders who have allegiances to the next generation, not just to their own pockets. While it is convenient for corporations to put the burden of climate change on the consumer, in reality corporations are indisputably the greatest contributors to global climate change. Graduates of elite higher education institutes are often the citizens who end up running governments, organizations, and multi-national corporations. They are key players in the environmental crisis post graduation, and thus, this research will focus on creating EL in elite higher education contexts specifically. If elite higher education intuitions continue educating leaders per the status quo, future leaders will continue to allow faceless corporations to wreak havoc on the earth. The magnitude of this crisis cannot be understated; the next few centuries will be tumultuous at best without environmentally literate leaders.

This is not exactly news in world of academia. Environmental studies departments and student clubs are the norm on most college campuses. The key difference between current environmental opportunities on most campuses and necessary future curriculum is educating *all students* to be environmentally literate citizens, not just those who take an interest in the subject. Fortunately, many higher education institutes, including Colby College, have accepted the reality of the environmental crisis and begun altering their habits. As an institution, Colby has committed in its Summary of Values:

> to nurturing environmental awareness through its academic program as well as through its activities on campus and beyond. As a local and global environmental citizen, the College adheres to the core values of respect for the environment and sustainable living. Colby seeks to lead by example and fosters morally responsible environmental stewardship. Environmentally safe practices inform and guide campus strategic planning, decision-making, and daily operations. We urge community members to recognize personal and institutional responsibilities for reducing impact on the local and global environment. Finally, we recognize that achieving environmental sustainability will be an ongoing challenge that evolves as we become more aware and educated as a community.

This commitment, found in the Colby College Catalog, speaks volumes about the college's progressive and responsible ideology. It establishes environmental stewardship and education as priorities for the college community. When asked, "Are there areas where Colby can be truly distinctive?" Chair of Colby's Board of Trustees, Bob Diamond, has even named "environmental science" as an "[area] where Colby can be truly distinctive," (Weir, 2011).

Colby does not just talk the talk either. In many respects, the college has been an environmental pioneer. Our Environmental Studies department was one of the first in the country, established in 1971, and Colby's Professor Emeritus of Economics Thomas Tietenberg,

pioneered the field of environmental economics (History of ES). In 2013, Colby became the fourth college in the nation to reach carbon neutrality. The list goes on: the administration receives recommendations on environmental initiatives by an Environmental Action Group compromised of students, faculty, and staff; an Office of Sustainability and a fulltime Director of Sustainability guides campus initiatives; we have incredibly active environmental clubs such as EcoReps, EnviroCo, and CARE; 12 buildings on campus are LEED certified; and we receive 60% of our energy from biomass (Green Colby).

These are all spectacular initiatives that any organization should be prioritizing. However, it is unclear how many of these initiatives are felt in the daily lives of Colby College students. While many students do actively engage in an environmental club, take courses in the environmental studies department, or recycle regularly, no curricular initiatives exist that educate the entire student body about EL. Colby was at the forefront of the national movement to acknowledge environmental studies as a discipline, Colby pioneered sustainability and carbon neutrality on its physical campus, and now Colby must step up to the challenge of responsibly educating all students. As stated in the College's Summary of Values, "we recognize that achieving environmental sustainability will be an ongoing challenge that evolves as we become more aware and educated as a community." A logical next step in this evolution is to provide all students with the skills needed to succeed on a rapidly degrading planet. It is safe to say that decisions and lives of 1,800 Colby graduates each year have as much, if not more, impact on the earth than Colby's campus itself. The college must commit to the environment academically, not just as a physical campus.

This is essential for a variety of reasons, even beyond the health of the planet. For example, from the college's standpoint, employers are increasingly seeking college graduates

who have some level of environmental literacy (Fieselman & Lindquist, 2013, p. 22). As graduates of an elite liberal arts institution, Colby students will be decision makers, leaders, and doers at countless organizations. What skills do these future leaders need? They need to be able to live, succeed, and guide others on a planet that is degrading drastically.

A 2010 survey of 760 of the United Nations Global Compact CEOs identified sustainability as "truly top of mind for CEOs around the world." Interestingly, in 2007 the same sample of CEOs identified sustainability as "just emerging on the periphery of business issues," (Lacy et al., 2010, p. 10). Moreover, 81% of CEOs surveyed in 2010, compared to 50% in the 2007 survey, stated that sustainability is now fully integrated into the operations and strategies of their company (p. 33). The rapid change in CEOs' perceptions and application of sustainability over just a three-year period is indicative of the powerful global movement towards living sustainably. It's also indicative of an urgent demand for employees with skills in sustainability. Furthermore, the study found that,

> "CEOs see a critical need for business schools and education systems to focus on developing the next generation of managers and business leaders with the knowledge, skills, attitudes, and behaviors to manage sustainability issues as an integral part of the way they think about business," (p. 49).

Given the range of industries represented by the 760 CEOs in this survey, this data demands an interdisciplinary approach to education for sustainability. The world certainly still needs forest rangers and wildlife biologists, but the job description of an environmentalist is rapidly expanding. Furthermore, the job description of a CEO now includes *environmentalist.* With a 2014 Forbes ranking of 39th out of America's 2,870 four-year undergraduate institutes, Colby graduates are, and will continue to be, among the top decision makers, advisors, and leaders of

powerful institutions. The college has the opportunity (and perhaps, obligation) to instill in all future leaders the knowledge and skills to bring sustainability to whichever career they choose. Failing to provide this foundation for students in all disciplines is a disservice to Colby graduates. Like skills in reading, writing, or math, EL is becoming an essential skill sought after by employers. The necessity for environmentally literate employees will only increase as the crisis develops.

For hundreds of years the institution of higher education has facilitated the distribution of knowledge, provided a space for discovery, and stepped up to challenges. However, higher education has also propagated problems such as income inequality and racial discrimination in the past. As the hub of intellectualism, academia dutifully took powerful measures, such as implementing affirmative action, to right these wrongs. In a similar vein, higher education has produced the scientists, decision makers, politicians, CEOs, and overall cultural norms that allow us to destroy the very earth we depend on for sustenance without second thought. In fact, we call this 'progress'. While one could debate the definition of 'progress' forever, it is safe to say that progress is not 6.7 inches of sea level rise over the last century. It is not an increase in ocean temperature by .302 degrees Fahrenheit or an increase in ocean acidification by 30%. These are all unfortunate side effects of the progress we celebrate. They are side effects of an education system that has produced brilliant people with little perspective beyond their individual field or circumstance. Just as higher education rose to the occasion in the past, it must lead the way in the environmental crisis by broadening both the definition of progress and the minds of leaders to consider the health of the planet as a moral imperative inextricably tied to human life.

This challenge is daunting, and a deep understanding of the environmental crisis can be extremely unsettling. Any environmental studies student can recall class lectures that led to full

days worth of guilt. While the challenge to educate all students in an environmentally literate manner may seem enormous, it is insignificant compared to the consequences of failing to do so. To quote Reg Morrison, "Here we stand at midnight, all six billion of us huddled together upon our small bank and shoal of time, with sea levels rising and an environmental storm gathering about us. The fate of our species hangs in the balance, and the matter will be decided for us within the next millisecond on our evolutionary stopwatch." We're on the bank and now is the time to take action.

As understood from the U.N.'s study of CEOs, environmental leadership cannot be contained to solely environmentalists or environmental studies departments. In the past, "Most environmental professionals [were] primarily involved in trying 'to fix' environmental problems," Nair et al. (2002). Certainly the business of 'fixing' is necessary, but the interdisciplinary nature of environmental problems necessitates an environmentally literate population to end the cycle of degrading the environment and allocating resources to 'fix' the after math. Educating for environmental literacy in higher education will help expand environmental stewardship beyond environmentalists and into the daily decisions of all citizens and leaders whose actions consistently shape the environment.

In order to make this a reality, we must first ask "What does effective education for environmental literacy at the college level look like?" Then we must figure out *how* to implement these effective initiatives. To understand this subject in the context of Colby, it is important to understand the environmental climate at the college and to assess levels of environmental literacy in current students. A combination of answers to all these questions will inform suggestions for the college about giving all students an environmentally literate education.

The purpose of this research project, therefore, is to understand exactly what type of environmental programming or curriculum is necessary and effective in elite higher education settings. What initiatives have colleges and universities taken to successfully nurture environmental literacy in all students? More specifically, which measures at Colby contribute to environmental attitudes and behaviors, and how can the college support these in all students?

Literature Review

Theorists, politicians, researchers and administrators all over the world have been working to create environmentally literate citizens since the late 1960s. National and international commitments, along with programs that rate colleges based on sustainability, have brought the issue to the forefront of administrators' minds. Furthermore, a wealth of peer-reviewed research exists to assess which types of initiatives at schools actually lead to increased environmental attitudes or behaviors in students. These resources, combined with information regarding successful programs at peer institutions, will help inform the types of changes that could occur at Colby.

National and International Initiatives

The prospect of higher education as a major player in the environmental movement is nothing new. "Fostering environmental literacy for all" was first expressed as an explicit goal by higher education institutes in the Talloires Declaration of 1990. Originally composed at a conference in France, 472 universities in over 40 countries, excluding Colby, have signed the Declaration to date (Talloires Declaration). A report from The Presidents' Conference of 1990, which resulted in the Talloires Declaration, explains,

> "Universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future," (Report and Declaration of The Presidents' Conference, 1990).

A similar initiative, The American College and University Presidents' Climate Commitment, originated in 2007. It is a pledge signed by colleges and universities to pursue climate neutrality and to promote education that will encourage the greater society to follow suite. The Commitment's mission statement acknowledges:

> "The unique responsibility that intuitions of higher education have as role models for their communities and in educating the people who will develop the social, economic and technological solutions to reverse global warming and help create a thriving, civil and sustainable society." (Climate Commitment, 2007).

To date, 685 college and university presidents, including former President of Colby College, William 'Bro' Adams, have signed the Commitment. While this pledge focuses on carbon neutrality in higher education, the Association of the Advancement of Sustainability in Higher Education (AASHE) has pioneered The Sustainability Tracking, Assessment and Rating System (STARS), through which universities can report their sustainable practices. STARS takes into account categories of: Institutional Characteristics, Academics, Engagement, Operations, Planning and Administration, and Innovation. Concrete data submitted by individual institutions allow STARS to rate institutions' practices of sustainability, and also allow for a healthy level of competition between schools. Thus far, STARS has received 513 registrations, 299 submissions from institutions, and 532 yearly renewals. At Colby, we are proud to say that we have the third highest STARS rating of all colleges and universities in the country (STARS, 2014). STARS's parent organization, AASHE, also conducts workshops, holds yearly conventions, finances research, and provides curricular resources for incorporating sustainability into higher education (News and Resources, 2013).

Perhaps appropriately, AASHE was formed in 2005, the same year that the United Nations Educational, Scientific and Cultural Organization (UNESCO) launched the Decade for Education for Sustainable Development (DESD). As the DESD ends this year, outcomes have not yet been released, but a 2012 Report, *Shaping the Education of Tomorrow,* has found an increase in experiential pedagogy and the implementation of sustainability content (pg. 29). Integral to the discipline of environmental education, experiential and problem solving curricular activities couple well with textbook environmental curriculum.

Environmental education initiatives such as The Talloires Declaration, STARS, and DESD underscore the crucial role of higher education institutes in the environmental crisis. They promote sustainable practices on schools' physical campuses and in curricular offerings as both necessary institutional changes and as guiding principles for society at large. The theories behind these initiatives emphasize the role of graduates of higher education in bringing essential environmental values and practices into workplaces all over the world.

Defining Environmental Literacy

Charles Roth's landmark work, *Curriculum Overview for Developing Environmentally Literate Citizens,* introduced environmental literacy as a goal within the broader discipline of environmental education (EE) (Roth, 1968). No single practice, curriculum, or definition of EL exists today, however, Roth's 1992 review of his original essay provides a framework for a working definition. It defines an environmentally literate citizen as someone who:

- Recognizes environmental problems as they arise
- Evaluates all facets of an issue before taking action
- Favors long term benefits over short term gains
- Takes tangible action towards curbing consumer, governmental, and/or work place environmental imbalances

- Recognizes learning as a life long process
- Is humane
- Recognizes the interrelatedness of all living things
- Treats public and private property with equivalent respect
- Understands and acts upon an obligation to sustain the earth for future generations' survival
- Is willing to curtail individual privileges that otherwise negatively affect the long range public good
- Recognizes the impact of a growing human population on ecosystems
- Supports environmental diversity
- Continually reexamines his or her own culture and makes changes that promote healthy long term interaction between humans and the environment (Roth, 1992).

While this definition of an environmentally literate citizen may be long, each condition above is founded on the basic principle of *supporting life for both humans and the natural world*.

Unfortunately, most humans do not live up to this principle today. We view the earth as a compilation of resources to exploit and consume rather than as the one source of sustenance for our entire species. Even from an anthropocentric standpoint, the health of the earth should be of highest priority to us. Instead, values such as domination, greed, and consumption, which are engrained in the Western frameworks of government, religion, and economy, dictate our everyday interactions and decisions. Modern social justice movements, often taking root in higher education, have worked to change these oppressive values within Western culture. We have seen decades shaped by women's suffrage, by the civil rights movement, and by sexual revolutions. Each of these movements derives from the dualism of humans versus a subordinated someone or something else. Val Plumwood (1993) articulates examples of these fundamentally connected dualisms, such as "human/nature, male/female, mind/body, reason/emotion and civilized/primitive" (p. 43). The first word in each pair represents the 'superior', while the latter represents the 'inferior'. Inherent in the human/nature dualism is human superiority and dominance. Perhaps as a defense mechanism, Western culture systematically labels social

movements, for example, movements toward equality between humans and nature, as radical and/or naive.

Plumwood's definition of a dualism includes a "denied dependency" upon the inferior by the superior (p. 41). While Western culture certainly has scientific proof that humans depend on nature, our actions of domination and consumption, leading to environmental degradation, suggest a cultural denial of this dependency. In addition to recognizing our dependency on nature, Plumwood explains that ending the human/nature dualism "requires the reconstruction of relationship and identity in terms of a non-hierarchical concept of difference," (p.60). While difference is inherent in any two things, the hierarchical categorization of two things is crafted by man. Acknowledging and working to dismount the hierarchical categorization of man vs. nature is essential to EL.

How does one go about dismounting a historically, culturally, and economically rooted hierarchical classification? The movement towards environmental justice relies on education just as movements towards racial or gender equality do. However, while education for gender equality, for example, has the opportunity to work with both the oppressor and oppressed, EL can only target the oppressor. As awful as it is to accept, the majority of present day humans fit into this category. Accordingly, education for environmental literacy must reach the majority of humans. Here, higher education is unique because its graduates move on to make public decisions that impact entire populations of people. When higher education educates for EL, repercussions in the form of changed understandings and practices of domination can be felt all over the world.

Assessing Environmental Literacy

While the theory behind EL suggests that it has the potential to take root and create positive change in higher education, evidence based research into curricular strategies and their effectiveness is necessary. This research is already widely available, with dozens of studies contributing to the basis of EL established by Charles Roth. Most definitions of EL include four major aspects: knowledge, affects, skills, and behaviors (Roth, 1992).

Knowledge generally includes facts regarding climate change, ecological systems, consumption, and the relationship between humans and the environment. It emphasizes systems thinking on both global and local scales to understand human impact on the environment. For further curriculum standards, Roth (1968) lists very specific learning outcomes (p. 8-19) that all high school graduates should achieve in order to make responsible choices concerning the environment. These can also inform a holistic higher education science curriculum. Roth's 1992 work lists similar standards of curriculum development to his 1968 work, but instead divides them between the four major aspects of EL previously mentioned (p. 28-34).

The second of these aspects, *affects,* includes attitudes and responsibility surrounding the environment (Quo-Cheng et al. 2014). These may include the motivation and responsibility to actively improve the environment, willingness to let go of personal privileges or luxuries that add to environmental degradation, establishment of personal environmental ethics, or balancing love of the environment with love for humanity (Roth, 1992).

Next, *skills* outcomes include the ability to understand evidence through the interpretation and critique of scientific data and literature. Skills outcomes also involve differentiating fact from opinion, imagining alternatives, and forecasting patterns (Roth 1992).

Behavior outcomes, perhaps the most important to the success of environmental movement, include evaluating actions based on their consequences for both human and natural

communities, advocating for the health of these communities, and demonstrating EL through every day actions (Roth 1992). Studies have found that all four of these aspects are needed in varying degrees in order for a person to become truly environmentally literate (Goldman et al. 2014; Quo-Cheng et al. 2014; Teksoz et al. 2011). Each aspect builds off of the other to create a frame of mind centered on environmental stewardship and informed action.

A simplistic linear model of EL would assume that a student's understanding of scientifically based environmental *knowledge* and *skills* would lead to an environmentally sympathetic *affect* and result in a change in *behavior*. Unfortunately, studies over the past 30 years have disproved this assumption (Teksoz et al., 2012, p. 159).

A study by Goldman et al. (2014) evaluated environmental literacy in student teachers - a fitting sample population given the key role of educators in the movement towards EL in education. Using a survey based on environmental behavior, attitudes, knowledge, and background variables, researchers assessed EL in student teachers during their first year of college (pre-test) and three years later (post-test). More specifically, researchers gauged the difference between environmental behaviors, attitudes, and knowledge in students in environmental affiliated fields (EAF) versus non-environmental affiliated fields (NEAF). EAF majors included biology, environmental studies and agriculture, geology, and geography.

The study found significant differences between EAF and NEAF students' environmental knowledge post-test. After their courses of study, EAF students' knowledge increased significantly while NEAF students' knowledge stayed the same. Surprisingly, findings within the attitude category showed that EAF students scored 'Value of nature' significantly lower on the survey at the end of their course of study than they did at the beginning. Additionally 'Value of nature' scored significantly higher amongst NEAF students than EAF students. EAF students

did, however, score 'Importance of environmental education' (in the attitude category) significantly higher than their peers after their course of study (p. 375). Neither EAF nor NEAF students showed significantly different changes in overall behavior (374). When asked about the influences that contributed to their environmental worldview and self- perceived EL, EAF students cited 'disciplinary studies' as the greatest contributor, while NEAF students cited 'processes of personal maturation' as the greatest contributor. Both majors cited 'on campus events and activities' as the least important factor in the transformation of their environmental worldview and self perceived EL (p. 376).

The results of this study verify that increased scientific knowledge does not lead to an overall increase in environmental attitudes or behavior. As an EAF student cited in the study stated, "The [science] courses provided content but did not develop thinking or encourage attitudes." Clearly EL cannot be solely equated with the study of ecology or biology. These results support the call for a more interdisciplinary approach to both environmental education and EL. Effective EL should include the systemic political, economic, cultural and real life implications that are essential to a rich understanding of environmental problems (p.379).

Building on this conclusion, Qou-Cheng et al. (2014) found that "without attitudes and responsibility as mediators, greater knowledge indicated poorer behavior," (p. 173). The study looked at green building design students and the relations between their knowledge, affects, and behaviors. Within the category of *knowledge*, researchers established subcategories of *knowledge for facts, knowledge for action,* and *knowledge for design skills*. The first subcategory asked questions such as, "What are the characteristics of green materials?" the second asked questions comparable to, "Which action could be taken to save energy and reduce CO_2 emission?" and the third subcategory asks questions such as, "What approach should be used to select energy-saving

air conditioners and lighting devices?" (p. 177). Comparing the first question to the second two, it is clear how the subcategories within the aspect of *knowledge* are essential. For example, *knowledge for facts,* similar to the purely scientific courses studied in Goldman et al., did not ask for any cognition beyond the memorization of facts. On the other hand, the second two categories, *knowledge for action* and *knowledge for design skills* asked questions that encouraged students to apply facts to environmental decision-making.

The study found that all categories of knowledge had negative correlations with the behavioral categories of *involvement* and *willingness* (aside from knowledge for design skills, which had a positive correlation with willingness), but had positive correlations with the behavior categories of decision-making and practices (p. 179). The only explanation discussed for the negative correlations between knowledge and behaviors was 'self-confidence'; clearly further research is needed here (p. 179).

In regard to *affects,* each category of knowledge had positive correlations with the sub-categories of responsibility and attitudes. *Knowledge for action*, specifically, was the strongest predictor of responsibility and attitudes. Furthermore, attitudes were found to be the most important predictors of behavior. People with favorable environmental attitudes are more likely to have high levels of personal responsibility and maintain environmentally responsible behaviors. Researchers suggested that attitudes could be improved by creating personal obligation to, for example, save energy, which would result in feelings of guilt when the individual failed to save energy (p. 180).

In conclusion, Quo-Cheng et al. (2014) found that increased knowledge does not guarantee environmentally friendly practices. Knowledge for action and design skills, however, will increase environmental behavior, especially when coupled with environmental attitudes (p.

182). In essence, effective environmental education necessitates an explanation for the student as to *why* a practice is sustainable and *how* to implement it rather than simply stating that the practice *is* environmentally responsible (p. 180).

The findings from each of these studies are somewhat in line with conclusions from a study conducted by Teksoz et al. (2012). This study worked to explain the relationship between environmental attitudes, responsibility, concern, knowledge, and outdoor activity in university students (p. 157). It found environmental knowledge to be a significant predictor of environmental concern, attitudes toward the environment, and environmental responsibility. A key difference in the definitions of *knowledge* used in each study is important here. Teksoz et al. (2012) surveyed environmental knowledge based on a series of 11 questions related to "general environmental topics emphasized in the Turkish formal education programs or in the mass media," (p. 161). This type of environmental knowledge is substantially more interdisciplinary than the knowledge likely garnered from science courses in Goldman et al. (2014) or from knowledge for facts in Quo-Cheng et al. (2014). In fact, Quo-Cheng's (2014) classification of knowledge into three subcategories further emphasizes the varied definitions of the category of *knowledge* that can be found within studies of EL.

Nevertheless, the conclusion from Teksoz et al. (2012) that environmental knowledge positively impacts environmental affects aligns with the general findings of the previous two studies: environmental knowledge, as opposed to, for example, strictly biology, will positively impact students' environmental affects, or their attitudes and responsibility. While neither Teksoz et al. (2012) nor Goldman et al. (2014) studied the effects of affects on behavior, findings in Quo-Cheng et al. (2014) support the claim that environmentally friendly affects will positively impact environmental behavior.

Implementing Environmental Literacy

This research clearly refutes the notion that EL (or even environmental education) is fostered on campus by imparting knowledge in the form of science courses alone. Fortunately, colleges and universities all over the world have tried a variety of methods to teach students environmentally literacy. As Paul Rowland's Foreword to the book, *Higher Education for Sustainability*, points out "There has been no single pathway to success in developing and implementing the sustainability education curriculum," (2013, p. IX). Furthermore, environmental education in its truest form is not confined to a textbook; instead it involves real problems, innovative solutions, and constant creative collaboration (Karim et al. 2013, p. 75). These methods can be broken down into a few categories: interdisciplinary curriculum requirements, environmental departments, sustainability on the physical campus and experiential learning opportunities.

All College Distribution Requirements

Colby is a liberal arts institute through and through. We pride ourselves on multidisciplinary, collaborative learning. The first sentences of our Mission states, "Colby is committed to the belief that the best preparation for life… is a broad acquaintance with human knowledge," (Colby Plan). In an effort to broadly acquaint students with knowledge, the College requires students to take distribution requirements outside of the requirements of their own major. These include, for example, 'social sciences,' 'quantitative reasoning,' and two courses in 'diversity.' The *Summary of Colby Values* states that Colby "recognize[s] that achieving environmental sustainability will be an ongoing challenge that evolves as we become more

aware and educated as a community." Certainly there are many directions in which this evolution can occur, both physically on campus and through curricular initiatives. But Colby already does an incredible job with physical sustainability on campus, as evidenced by our STARS rating of 3rd in the country. The next logical step is to carry out the sustainable values that the College is already committed to through academics. In this section, I will demonstrate how including an environmental distribution requirement could be a logical and realistic next step in Colby's commitment for sustainability.

Universities all over country have implemented EL distribution requirements with the intention of educating all students, regardless of discipline, to be responsible citizens of the earth. They understand sustainability as a moral obligation, not just an academic discipline. For example, in 1993, University of Georgia (UGA) became one of the first universities to create an EL requirement. The President of UGA at the time, Charles Knapp, viewed environmentalism as a priority of his administration, so implemented an undergraduate environmental literacy requirement (ELR). As a university consisting of 30,000 undergraduate students separated in different colleges, this was a monumental task for UGA (Moody et al. 2005). After implementation, a 1996 study evaluated the outcomes of the requirement by using pre and post-course surveys, with an additional 8-month post-course survey to assess student retention of the material. Results from the surveys showed a significant increase in students' environmental awareness immediately post-course and 8-months post-course, proving the success of the ELR.

The students surveyed were enrolled in ELR courses within the anthropology, ecology, and geography departments. Overall, students indicated that they learned the most content in the ecology course, and according to the curriculum, the ecology courses had contained more information from the natural sciences than the other courses. However, according to the survey,

students in the ecology course also retained the material at a significantly lower rate than their peers in the anthropology and geography departments. Authors attributed this to the focus on content rather than systems or relationships in the ecology course (Moody et al., 2005, p. 7). This finding provides important guidance as to the effectiveness of content within EL courses; it directly supports findings in Goldman et al. (2014) that prove ecological education alone will not lead to EL. Ecological education is certainly important; ecology is the basis of all life on earth. However, curriculum for an EL distribution requirement should feature more breadth of material.

A subsequent 2001 study of the ELR at UGA found that 90% of students consider ELR to be an important part of their education. Of faculty surveyed, 94% found the ELR important and appropriate (Moody et al. 2005). Moody et al. (2005) conducted the last formal research study on the ELR at UGA, but according to its' website, UGA has made substantial progress in supporting the ELR since 2005. Because the requirement has long been plagued by financial and organizational trouble, UGA implemented a $3 per year "Green Fee" for all students who pay tuition. This fee allowed the administration to create an Office of Sustainability that was needed to logistically and academically support the ELR. The "Green Fee" now funds two thirds of the Office of Sustainability budget, including three full time staff and dozens of paid and unpaid internships. Part of the Office's role in the ELR includes holding workshops for faculty curriculum development and hosting a sustainability breakfast once a semester intended for interdisciplinary collaboration and networking between faculty (UGA Office of Sustainability). These initiatives are essential to the ELR because of the interdisciplinary and evolving nature of the environmental curriculum requirement. The ELR would not succeed without these opportunities for faculty collaboration and education.

University of Maine (UME) also has a general education course requirement called *Population and the Environment.* At UME, each academic program must offer classes that fulfill six broad general education requirements. One of these requirements, "Human Value and Social Context", has the sub-category requirement of "Population and the Environment" (University of Maine, 2014). In 2012, the University offered 82 classes that fulfilled Population and the Environment.

A study at UME in 2007, conducted by Anderson et al., addressed attitudinal changes in students after taking the requirement. The mean survey scores showed significant attitudinal movement in eight of the fifteen questions asked. Surprisingly, this movement was towards both 'green' and 'brown' ends of the environmental literacy spectrum (p. 158). The authors credit this bilateral movement with the lack of an explicit learning goal of attitudinal change cited in the learning outcomes of the distribution requirement. Change in attitudes as a goal is *implied* in the outcomes, but with such a broad variety of professors and courses offered, authors suggest that the goal of attitudinal change should be *explicitly stated* in the outcomes (p. 163).

A similar study conducted at UME in 2011 explored the effects of different professors administering a variety of courses to fulfill the same requirement. Contrary to the study conducted four years earlier, this survey showed statistically significant changes in overall (rather than just mean) student attitudes. These changes in student attitudes (towards 'greener' or 'browner' values) were substantially dependent on the instructor, rather than the curriculum (Teisl et al., 2011, p. 79). Authors noted that some people might argue that this is a good thing; perhaps changing student attitudes is not within the role of higher education (p. 80). However, attitudinal change is an explicit goal of EL, and thus, a commitment to EL implies a commitment to attitudinal change towards "green" values. Explaining this intent explicitly in the student

handbook and to professors could have created "greener" outcomes in student attitudes (Anderson et al. 2007, p. 163). As seen at UGA, offering opportunities for faculty collaboration and learning would have also had a positive effect on outcomes.

In 2008, Furman University, a small liberal arts school similar to Colby, implemented a distribution requirement called "Humans and the Natural Environment." (Halfacre et al. 2013, p. 186). By 2011, 31 new courses in 11 departments were available to fulfill the requirement (p. 193). The university, located in South Carolina, aided faculty in this curricular transformation by co-creating curriculum development workshops with Middlebury University to support faculty interested in either incorporating sustainability into their courses or creating entirely new courses. 59 faculty members from 21 of Furman's 24 academic departments attended, allowing for diverse interdisciplinary collaboration and networking (p. 195).

Furman has also seen student engagement in sustainability growing since 2008, however data that assesses student environmental attitudes after fulfilling the requirement is not available (p .193). Empirical evidence of its success, however, underscores the essential nature of opportunities for faculty members' personal learning and curriculum development around sustainability. Additionally, the description of Furman's distribution requirement explicitly states its goal of "fostering an appreciation for [our] dependencies" on the natural world (Furman University). This explicit statement, combined with a space available for faculty learning and discussion around sustainability, provides a solid foundation for the success of the university's "Humans and the Environment" requirement.

Faculty Engagement

As seen in the cases of UGA, UME, and Furman, the success of implementing an environmental distribution requirement is dependent on faculty engagement. This makes sense; professors are responsible for developing and teaching the courses. However, creating faculty engagement requires intentional reeducation, collaboration, communication, and planning. As David Orr mentions, "The reeducation of teachers, administrators, and boards of trustees must be a high priority. Those presuming to shape the minds that will shape the future must comprehend what the future requires of them," (Earth in Mind, p. 127). This reeducation is vital, if only given the fact most professors have never taken an environmental studies course. Additionally, the fact that UME's "Population and Environment" requirement was making half the students become "browner" rather than "greener" shows the need for education and discussion with professors around the intended outcomes of the distribution requirement. The *Summary of Colby Values* insists on "[fostering] morally responsible environmental stewardship." Professors teaching the course should align the values of their curriculum with the College's values.

In addition to education, faculty collaboration is essential to the success of an environmental distribution requirement. Like environmental issues themselves, a distribution requirement summarizing them needs to take a multidisciplinary approach. Whether collaborative teaching inside the classroom, or simply opportunities for networking, debriefing, and brainstorming outside of class, faculty collaboration is essential. Hundreds of examples of this exist and no blanket system will fit every college. For example, UGA holds 'sustainability breakfasts' a few times a year for faculty to discuss what works and what doesn't (Sustainability UGA). Middlebury and Furman have co-created faculty workshop curriculum to encourage holistic understandings of sustainability among faculty. Workshops leaders strive to help individual faculty in various discipline introduce sustainability into their subjects and even create

new courses. This is based on the notion that sustainability relates to every discipline (Halfacre et al. 195).

Likewise, at Dalhousie University in Canada, understanding the interdisciplinary nature of sustainability was crucial to garnering faculty support. Faculty expressed the sentiment, "Why is sustainability more important than what I do?" The main response was that the "purpose of the university has always been to prepare students for an active life and to solve the major issues of our time." Sustainability is the major issue of our time, and a full understanding of this undoubtedly increased faculty engagement environmentally at Dalhousie. Holding university wide workshops and discussions, Dalhousie incorporated faculty, staff, and student input into their strategic plan for implementing environmental education into the curriculum (Wright, 2013, p. 207-208).

Faculty involvement and support serves as a vital component of any future initiatives Colby takes to incorporate environmental literacy into curriculum. The reeducation of leaders all over the world to introduce them to environmental problems and practices is becoming commonplace (Lacy et al. 2010). Because of the relatively short time frame inherent in the environmental crisis, reeducation of faculty will not take care of itself through a natural generational manner. Failing to do so, again, does a disservice to students. In the words of David Orr, the world needs professors whose ideas are, "dangerous to greed, shortsightedness, indulgence, exploitation, apathy, high-tech pedantry, and narrowness," (Earth in Mind, 103).

Other Initiatives

The world also needs *citizens* with ideas along the same lines: citizens with the courage and skills to demand and create change allowing for healthy communities. Higher education has

the ability to create these citizens, and perhaps the moral obligation to do so as well. Some options have been stated previously. Other options include incorporating sustainability into freshmen orientation seminars and freshman wellness seminars. Sustainability is crucial to the health of both our college community and the earth. Introducing it as a Colby value to open the minds of freshmen could lay the groundwork for higher levels of environmental literacy within the student body. This could also be done by explicitly introducing environmental literacy through the COOT program.

A very significant aspect of environmental education is also a personal connection to the outdoors, or a sense of place. This is difficult to formally require of college students, but countless creative measures could be instated at Colby to encourage respect for the outdoors. COOT is a great example of a program at Colby that often does this and has the potential to do so even more if the goals of the program specifically stated a commitment to sense of place.

Colby's 714-acre campus in Maine is also a huge asset to nurturing sense of place or environmental literacy. We already use this space quite productively with running and skiing trails, an arboretum, and an organic garden, for example. However, opportunities exist to enhance the use of this space such as creating an outdoor classroom or holding more campus events outside. An outdoor classroom could easily be constructed on Runnals Hill or in The Arboretum by simply building a circle of wooden benches. Imagine poetry readings or campus discussions in held in this venue. Wonderful potential exists in a project like this; it would only take a few creative and determined minds to get behind it.

Being outside, especially in this day and age when hours are spent inside at the computer is also important to both our physical and mental health. An entire field of study called Nature Deficit Disorder has emerged, linking a variety of health problems to limited time outdoors

(Louvre, 2005). It is also widely accepted that spending time outdoors can relieve symptoms of anxiety, stress, and depression. Creating opportunities for students to be outside clearly benefits their health, but also develops a respect for the environment. It allows them to further understand themselves as members of the living earth community rather than as consumers of its resources. Once this understanding occurs, the potential for love and respect can exist between students and the natural world. This relationship is essential for taking action on behalf of the environment. As explained by Stephen Jay Gould, "We will not fight to save what we do not love." Many approaches exist to foster this love and respect, especially on a campus as rich in natural life as Colby's.

Opportunities for environmental learning also occur in real world problem solving. After all, the environmental crisis is a real world problem in need of solving. As evidenced in the 2014 Goldman et al. study, knowledge for action is the greatest predictor of attitudes, and attitudes are the greatest predictor of behavior. If we are committed to the goal of increased environmental attitudes and behavior in students, then teaching students how to take action on real world environmental problem solving seems like an effective approach. Furthermore, "If the solution of real-world problems is at the core of sustainability science, then it is apparent that real world learning experiences should be an essential element of the educational process at every level," (Redman & Wiek, 2013, p. 219). For example, every college is located in a place, and every place has environmental problems. Specific opportunities for solving these problems could include collaboration with the Waterville community in the form of independent studies, formal classes, or partnerships with local professionals. A program like this would allow our students to practice real life problem solving, would address problems otherwise left unaddressed, and would create environmental awareness in the Waterville community. The relationship between

Waterville and Colby has room for improvement. Environmental stewardship could definitely provide a platform for mutually beneficial collaboration.

The aforementioned ideas only scratch the surface. Endless combinations of stirring conversations, creative ideas, tangible steps, and courage are needed to fulfill Colby's obligation to educate all students for future success, and hopefully, to advocate for a healthy world in the process.

Conclusion

Many social movements take time, however, this one is on a bit of a time crunch. Perhaps unfortunately, 97% of research confirms that climate change is a human caused reality. While many try to predict the outcomes of climate change, forecasting the interactions of millions of natural and human made systems is proving futile. What we need is courageous, educated leaders willing to make drastic and effective changes in support of living things. Higher education has an opportunity unparalleled by any other institution in the world. Elite higher education, in particular, molds the minds of world leaders for a precious four years. Just as environmentalists trained in ecology and biology will not be the leaders passing legislation to end wars, politicians educated solely in governmental matters will not have the skills to reverse global climate change.

> "The most pressing problems across the globe… are the result of dynamic biophysical, social, and psychological processes. Solving such wicked problems requires an educational system that trains students to be adaptive learners who can anticipate disruptions and envision their solutions and attendant opportunities at multiple scales – from the local to the geopolitical"
>
> – DeDee DeLongpre Johnston and Lucas Johnston

With climate change as the most pressing issue of our time, education must give learners the tools to successfully handle with it. As evidenced by studies of environmental literacy

curriculum, knowledge for facts about natural systems is important but will not create changed attitudes and behaviors on its own. Instead, knowledge for facts, along with knowledge for action and skills, leading to changed attitudes, will elicit personal responsibility and behavioral changes in students.

A citizenship informed about the environmental crisis is critical to the health of the earth and its inhabitants. In working towards this reality, one approach for colleges is to implement a distribution requirement for all students. While this takes logistical, financial, and educational resources, it has been done effectively at several schools across the country and resources are available to guide the process at Colby. The time to act is now, if not yesterday. What is the worst the can happen? As David Orr eloquently points out, the only danger is "that higher education will mostly opt out of the great ecological issues of the twenty first century because it cannot summon the courage to do." Colby has already demonstrated that it is not 'opting out,' but if it wants to continue being an environmental leader and responsible institute of education, the College must incorporate environmental literacy into academics.

Methods

Participants

This research project includes a survey designed to assess levels of environmental literacy within the Colby College student Body. Participants were limited to any current student at Colby College during the 2014-2015 school year. Colby is a four-year liberal arts College in Waterville, Maine with a 26% acceptance rate. The student body consists of 1,850 students, with 53% of students identifying as female and 47% male. They range in age from 17 to 23 years old and are undergraduate students in their first through fourth years of study. Colby students represent 44 states and 75 different countries.

The survey was completed by 266 participants, 70% of whom identified as female and 30% of whom identified as male. Students in their senior year comprised 33% of respondents, students in their junior year made up 28%, sophomore year consisted of 25%, and first year comprised 15% of survey respondents. Participants included students in every academic area of study at Colby. The survey did not ask for students' place of origin, ethnicity, sexual orientation, or socioeconomic class.

Interview respondents consisted of four males and three females. Five interviewees were seniors at Colby College and three were juniors. Their academic disciplines included physics, biology, environmental studies, government, and economics. Questions mirrored the qualitative questions featured in the survey.

Sampling Procedures

This survey was administered online via the website, *Qualtrics*, hosted by Colby College. Because the Colby Server hosts *Qualtrics*, participants needed to log into their online Colby

account in order to take the survey. This guaranteed that only Colby students took the survey. No student login information was saved in any form, so the survey was completely anonymous.

The link to the survey was distributed via email. Messages were primarily sent out via Colby's daily General Announcements email to all students. Professors in various departments also emailed the link to students in their classes and departments. There is no way of knowing exactly how many students saw the survey link in an email and decided for or against taking it. Although not all students read the General Announcements, all 1,850 Colby students *did* receive the survey in theory. A total of 266 students responded to the survey, which accounts for 6.9% of Colby's student population. Because the survey was available online via email, respondents took the survey on computers and laptops in various locations on campus or even while abroad. No compensations were given to respondents in exchange for their time. Colby College's Institutional Review Board approved this research project before we distributed the survey. Prior to beginning the survey, participants read a statement explaining their anonymity and their ability to skip any questions or end the survey at any time.

Survey Design

The framework for this study was built with Charles Roth's notions of knowledge, attitudes, skills, and behavior in mind. However, this survey only assesses attitudes and behaviors because knowledge is often factually based and skills are difficult to measure in a survey format.

Individual attitude scores were determined for each participant based on their responses to three survey questions designed to assess attitudes. In the same manner, student responses to

three questions designed to assess student behavior determined each student's behavior score. Student's combined EL score is a sum of attitude and behavior scores.

Student respondents represented such varied major courses of study, that student majors were divided into categories of study to ensure reliable sample sizes. These categories included: environmental studies, hard sciences, economics/government/history, arts/humanities, and social sciences. Although students listed their major and minor courses of study, students were categorized only by their primary major, with the exception of environmental studies students. Any student who listed environmental studies as their primary or secondary major or minor was categorized as an environmental studies student because they had been exposed to the curriculum.

The survey consisted of 15 questions and is included in the appendix of this study. Questions one and two, respectively, asked student their class year and gender. These statistics were not used in analysis of the results.

The third survey question asked student to identify their major(s) and minor(s) which were listed in a drop down window. These responses allowed us to group respondents into categories based on their major course of study. We only used the first major students listed, as including secondary major and minors contributed too many factors to the statistical analysis (with the exception of students who have studied environmental studies, as explained previously). A full list of categories and the majors that compromise them is available in the appendix.

Question number four asked students to list courses at Colby that helped them develop respect for the environment. This question was not used in the analysis of results, but will be

given to the college because it provides useful information on what *specific* courses have contributed to student EL.

The following question (five) asked student to describe any experiences at Colby inside or outside the classroom brought them awareness of their relationship with the environment. Results from this qualitative question informed an analysis of what curricular or extra-curricular programs already in place at Colby do contribute effectively to students' relationships with the environment.

Question six asked students how aware they were of environmental practices and problems during high school (HS). The purpose of this question was to understand if students are becoming more environmentally aware while at Colby based on their self identified levels of awareness upon arriving here. Based on their responses, students were divided into two groups: low vs. high levels of environmental awareness during HS. The EL scores of these groups, along with college major, were analyzed.

The following question, number seven, listed sustainable practices on campus and asked students to identify any they were aware of. This question was not analyzed in the results section because it relies more on participant knowledge and/or campus marketing than it does attitudes or behavior. It may be helpful to share with the college though so that they can see what sustainability initiatives students are aware of.

Question thirteen gauged student comfort with having an informed discussion about the environmental crisis. This comfort level could be seen as an indicator of environmental literacy. Students were given four choices ranging from 'casually converse about environmental awareness' to 'convince a stranger that the environmental crisis is real.' Responses to this

question were not included in the results section because upon examining the question format, it became clear that it was misleading and not quite indicative of student EL.

A final qualitative question, number 14, asked student what Colby can do to further develop respect for the environment and sustainable living for students. This open response question was used to assess what students view as environmental initiatives, opportunities, or programs that the College is currently lacking. It helped inform this study's discussion of tangible ways the school could take action to educate all students for environmental literacy.

Environmental Attitude Scores

Question nine asked students to what extent they are concerned about climate change. With five options ranging on a Likert scale from 'none' to 'an extreme amount,' responses to this question were ranked one to five and added to student attitude scores. The purpose of this question was to understand students' levels of concern about the environmental crisis.

The next question, ten, asked student how often they think about the effects of their actions on the environment. With five options on a Likert scale ranking from 'never' to 'very often,' this question was scored with a maximum possible five points and contributed to student attitude scores.

The final question contributing to attitude scores, number twelve, asked students if they agreed with the statement, "Colleges and universities have an obligation to help students develop respect for the environment and a commitment to sustainable living." A Likert scale of five options ranging from 'strongly disagree' to 'strongly agree' allowed students to score between one and five on this question. It served to assess students' assessments of higher education's potential obligation to educating students about the environmental crisis.

Table 1 *Survey questions that assess environmental attitudes and are included in attitude scores:*
9. To what extent are you concerned about climate change?
10. How often do you think about the effects of your actions on the environment?
12. How strongly do you agree/disagree with the statement: "Colleges and universities have an obligation to help students develop respect for the environment and a commitment to help students develop respect for the environment and a commitment to sustainable living"?

Environmental Behavior Scores

Question eight was included in respondents' behavior scores. It featured a list of environmental initiatives on campus and asked students to select which ones they participated in. This question had eight possible responses, the last of which was 'other' and featured a space for students to add an additional behavior. Because very few students took advantage of the 'other' option, this question was scored out of seven points so as not to decrease the behavior scores of the majority of respondents who did not add an extra initiative. The few who did respond to the 'other' option simply had a point added to their scores.

Behavior scores also included student response scores from question eleven, which asked students how often they alter their actions out of concern for the environment. A Likert scale allowed students to choose between five responses ranging from 'none' to 'very often.' Students could earn a possible maximum score of five on this question, which was added to their behavior score.

The last question, number 15, featured a Likert scale and asked students if they expected their career path to relate to the environment. The possible answers to this question, 'no,' 'maybe,' or 'yes' were ranked 1-3 and contributed to students overall behavior score. Career choice reflects student attitudes and behaviors about the environment, because as Charles Roth points out, an environmentally literate citizen "acts upon an obligation to sustain the earth for

future generations' survival." Choosing a career related to the environment is a definitive way to act upon an obligation the environment.

Table 2 *Survey questions that asses environmental behaviors and are included in behavior scores:*
- Please identify any of the following environmental initiatives you have participated in at Colby.
- How often do you alter your actions out of concern for the environment?
- Do you plan to choose a career path related to the environment?

Environmental Literacy Scores

Overall environmental literacy scores consist of the sum of respondents' attitude and behavior scores. EL scores include responses to a total of six questions featured in Table 1 and Table 2. For the sake of consistency and clarity, most of the results analysis relies on total EL score rather than attitudes and behaviors. Further study should be done to determine the interactions between attitudes and behaviors.

Results

Environmental Literacy Findings

Environmental literacy scores consisted of respondents' combined attitude and behavior scores. Within each category of college major, respondents' scores for EL were averaged to create mean EL scores for each major area of study. An ANOVA measured the differences between mean EL scores in different categories of major. Findings showed a significant difference $F(4, 250) = 25.81$, $p = .000$ between the environmental studies category and all other categories. Out of a possible score of 30, social sciences, government and economics, and arts and humanities showed average participant scores between 18.80 - 18.99 (See Table 3), and hard sciences scored a mean of 20.04. However, environmental studies students scored a significantly different mean (p=.000) of 25.08 out of a total possible score of 30.

Table 3

Mean environmental literacy scores for each grouping of college major

Category of Major	**Environmental Literacy[1]**
Environmental Studies	25.083*
Hard Sciences	20.044
Economics/Government	18.986
Arts/Humanities	18.875
Social Sciences	18.796

[1]Out of a possible score of 30; based on mean scores on survey questions 11-15 and 17
*Notes a statistically significant difference of p=.000

In an effort to determine whether students gained this environmental literacy at Colby, an ANOVA was conducted comparing category of major with student responses to question six, which asked, " In high school, how aware were you of environmental practices and problems?"

Based on their responses, students were placed into categories of either low or high HS environmental awareness. In all majors of study, with the exception of environmental studies, students with low HS awareness had average current EL scores between 18.67 – 19.64 (See Table 4). Environmental studies students scored significantly different $F(4, 115) = 2.901$, $p=.011$ than only their peers in hard sciences with low HS awareness.

A second analysis compared students with high HS awareness based on major and EL score. While hard sciences and environmental studies students had current EL scores of 23.71 and 23.94 respectively, all other majors' scores ranged from 21.07 – 21.41 (See Table 4). It is interesting to compare the EL scores of hard science students who entered college with low vs. high environmental awareness. Hard science students with low HS awareness have the lowest current EL scores, while hard sciences students with high HS awareness scores have almost identical current EL scores to their ES peers. More research should be done to explain this.

Table 4

Mean EL scores of students with low vs. high environmental awareness in high school

High School Awareness	Category of Major	Environmental Literacy[1]
Low	Environmental Studies	22.727*
	Hard Sciences	18.667
	Economics/Government	19.641
	Arts/Humanities	19.154
	Social Sciences	19.533
High	Environmental Studies	23.936**
	Hard Sciences	23.706
	Economics/Government	21.071
	Arts/Humanities	21.105
	Social Sciences	21.412

[1]Out of a possible score of 30; based on mean scores on survey questions 11-15 and 17
*Notes a statistically significant difference of p=.011 when compared to Hard Sciences
**Notes a statistically significant difference of p=.003 - .016 when compared to Arts/Humanities and Economics/Government, respectively

Environmental Attitudes Findings

Next, an ANOVA was conducted to assess the relationship between major divisions of study and student environmental attitudes. Student responses to the three previously outlined attitude questions were combined to create a total attitude score for each student. The results are shown in Table 6. Out of a possible score of 15, all areas of study, with the exception of environmental studies, had a mean participant score between 11.10-11.36 (see Table 5). Environmental studies had a significantly different mean attitude score of 13.7: $F(4, 250) = 15.867$, $p = .000$. The next highest discipline was hard sciences, followed by economics and government, then arts and humanities, and lastly, social sciences. Post hoc pairwise comparisons revealed that the difference between environmental studies and other areas of study is significant.

Table 5

Mean attitude scores for each grouping of college major

Category of College Major	**Attitude**[1]
Environmental Studies	13.7*
Hard Sciences	11.356
Economics/Government	11.319
Arts/Humanities	11.313
Social Sciences	11.102

[1]Out of a possible score of 15; based on mean scores on survey questions 12, 13, and 15
*Notes a statistically significant difference of p=.000

Respondent answers to three different questions made up attitude scores. The first question (number nine on the survey) was "To what extent are you concerned about climate change?" Results show that 98% of sampled Colby students are concerned about climate change (see Table 6). 42% of students rate their level of concern as *quite a bit* and one third of students

say they are concerned to *an extreme amount*. Only 2% of respondents are not concerned about climate change.

Table 6

To what extent are you concerned about climate change?

Answer	**Frequency**
None	4 (2%)
A Little	14 (5%)
Some	48 (18%)
Quite a Bit	113 (42%)
An Extreme Amount	87 (33%)
Total	*266 (100%)*

Building off concern for climate change, question number ten asked, "How often do you think about the effects of your actions on the environment?" Compared to the 33% of respondents (see Table 6) who were concerned *to an extreme amount* about climate change in the previous question, only 18% of respondents thought about the environmental effects of their actions *very often* (See Table 7). Most respondents (47%) thought about the environmental effects of their actions *sometimes.*

Table 7

How often do you think about the effects of your actions on the environment?

Answer	**Frequency**
Never	2 (1%)
Rarely	27 (10%)
Sometimes	103 (39%)
Most of the Time	85 (32%)
Very Often	47 (18%)
Total	*264 (99%)*

The final question reflecting students attitudes, number twelve on the survey, was "How strongly do you agree/disagree with the statement: 'Colleges and universities have an obligation to help students develop respect for the environment and a commitment to sustainable living?'" Seen in Table 8, 84% of student respondents at least agree with this statement, and 45% of students *strongly* agree.

Table 8

How strongly do you agree/disagree with the statement: 'Colleges and universities have an obligation to help students develop respect for the environment and a commitment to sustainable living?'

Answer	**Frequency**
Strongly Disagree	2 (1%)
Disagree	8 (3%)
Neither Agree nor Disagree	30 (11%)
Agree	105 (39%)
Strongly Agree	121 (45%)
Total	*266 (100%)*

Environmental Behavior Findings

A fourth ANOVA (see Table 9), measuring the relationship between area of study and behaviors, was also highly significant, $F(4, 252) = 27.84$, $p = .000$. Out of a possible score of 15, social sciences, government and economics, and arts and humanities showed average participant scores between 7.56 – 7.69, hard sciences scored 8.69, and environmental studies students scored a mean of 11.33. Again, ES students scored significantly different from every other area of study in post hoc pairwise comparisons. Hard science student scores were also significantly different from other areas of study with p values below .05 in each comparison.

Table 9

Mean behavior scores for each grouping of college major

Category of College Major	Behavior[1]
Environmental Studies	11.328*
Hard Sciences	8.689**
Economics/Government	7.671
Arts/Humanities	7.563
Social Sciences	7.634

[1]Out of a possible score of 16; based on mean scores on survey questions 11, 14, and 17
*Notes a statistically significant difference of p=.000
**Notes a statistically significant difference of p=.02-.03

Responses to three survey questions made up student behavior scores. The first question (survey question eight) asked respondents to, "Please identify any of the following environmental initiatives you have participated in at Colby." This question found that nearly all survey participants regularly recycle and use re-usable drink ware (see Table 10). Furthermore, well designed and publicized initiatives like the RESCUE sale and Free Cycle have about a 50% participation rate amongst respondents. However, only about a third of participants change their eating habits by participating in Meatless Monday or purchasing local food and very few participants regularly attended meetings of campus environmental organizations.

Table 10

Percentage of respondent participation in various environmental initiatives at Colby College

Behavior	Frequency
Recycle trash regularly	244 (93%)
Regularly use re-usable water bottles and/or coffee mugs	230 (88%)
Donate to the RESCUE sale and/or Free Cycle	136 (52%)
Celebrate Earth Day	93 (35%)
Participate in Meatless Monday	87 (33%)
Regularly purchase local food and/or goods	83 (32%)
Regularly attend meetings of environmental clubs	31 (12%)

The next question (survey question eleven) assessing student behavior asked, "How often do you alter your actions out of concern for the environment?" Table 11 shows how 47% of respondents *sometimes* alter their actions, while 30% alter them *most of the time* and 13% alter their actions *very often.* The responses to this behavior oriented question did not differ highly from the same question about attitudes. This may be because the format of the question allows for highly subjective responses.

Table 11

How often do you alter your actions out of concern for the environment?

Answer	**Frequency**
Never	2 (1%)
Rarely	26 (10%)
Sometimes	124 (47%)
Most of the Time	80 (30%)
Very Often	34 (13%)
Total	*266 (100%)*

Survey question number 15, the final question contributing to behavior scores, asked, "Do you plan to choose a career path related to the environment?" Half of respondents said *no*, 30% said *maybe,* and 20% responded *yes* (see Table 12).

Table 12

Do you plan to choose a career path related to the environment?

Answer	**Frequency**
No	132 (50%)
Maybe	80 (30%)
Yes	54 (20%)
Total	*266 (100%)*

Qualitative Findings

Student Experiences at Colby

The survey also asked respondents to "Please list/describe any experiences you have had at Colby that made you aware of your relationship with the environment (inside or outside of the classroom)". This question, formatted as an open response short answer, elicited a variety of passionate and descriptive responses from students. The experiences at Colby that were most frequently cited in student responses included: being outside in Maine, Colby Outdoor Orientation Trips (COOT), Colby Outing Club (COC) trips, initiatives from environmental clubs, participation in environmental clubs, classes at Colby, and conversations with friends.

Over 45 respondents wrote about getting outside in Maine as a contributor to their relationship with the environment. Responses such as "I love walking in the arboretum," "going on trail runs and hikes," "exploring Maine with my friends," and "early spring at Sugarloaf" were common. Students reflected on "being in Maine and seeing how gorgeous the state is and how much it needs to be preserved." Some students are made aware of their relationship with the environment "anytime I am outside experiencing the beauty of this place first hand." Another student simply stated that at Colby, "I discovered my love for being outside and in the woods." Furthermore, respondents cited the arboretum in 17 responses, skiing in 9, and outdoor class field trips in 7 responses as experiences at Colby that increased their awareness of their relationship with the environment.

A total of 67 students mentioned either participation in COOT or the COC (39 and 28 respectively) as programs that made them aware of their relationship with the environment. "Exploring Maine outdoors with the Colby Outing Club and COOT… helped me gain a better understanding and relationship with our local environment," stated one respondent. Another

explained that their COOT and COC experiences, "added to my awareness and love for the outdoors and the natural world." A third student expressed gratitude for "my ability to experience the outdoors through the COC and COOT as a means to experience, appreciate, practice, and teach environmental ethics." "Nights at the COC cabin," were also mentioned as an influencer of environmental awareness.

A total of 54 respondents credited student clubs such as EnviroCo, EcoReps, and CARE with increasing their environmental awareness. Broken down further, 31 student responses referenced initiatives by environmental clubs (as opposed to club participation). One respondent stated, "student efforts… have brought environmental issues to the forefront of my mind." Another found that "all of the EcoRep events have really taught me about my relationship with the environment." Specific events such as the *5 Minute Shower Challenge*, *Earth Week, FreeCycle*, and *Weigh the Waste* were all frequently cited as effective student initiatives. A total of 23 students identified as members of environmental clubs and found regular club participation to increase their environmental awareness. For example, "Many projects I have done [with environmental clubs] have made me very aware of my own relationship with the environment and ways I could improve the way in which I live." Another student involved in environmental initiatives on campus reflects, "Being an Eco-Rep this year has made me realize the extent at which some people do not care about the environment…. It's a sad notion and I hope it can change soon."

Classes related to the environment at Colby were also cited 37 times as instrumental in building student relationships with the environment. One student stated that Colby classes have "helped me think critically about our place in the natural world as well as the effect our modern

lifestyle has on the earth. This has largely helped me feel more aware of how my personal life can be improved to be more sustainable and conscious towards the environment."
Likewise another student found that, "discussion in my Philosophy of the Environment class has been extremely powerful and has made me question my relationship with the environment and the status quo." Another student answered the survey question with, "My entire time in HI394. That class was the definition of transformative." These responses were received in addition to responses on a separate question asking students to "List any courses you have taken at Colby that helped you develop respect for the environment and a commitment to sustainable living." Out of 266 total survey respondents, 187 students listed at least one course they have taken that fit the criteria in this question.

A final relevant impact on student environmental awareness was simply conversations with friends, which were cited in 18 different responses. "I usually learn TONS from my friends and classmates in the most simple ways," explains one student. Another reflects, "most of my friends are ES or EP majors and often discuss issues related to the environment and I have attended a dew lectures and guest speakers with them." Furthermore, "conversations with friends at lunch" and friends who "make me explore the great outdoors in Maine," were influential in creating environmental awareness on campus.

Of the 266 total survey respondents, 101 students provided responses to the question "Please list/describe any experiences you have had at Colby that made you aware of your relationship with the environment (inside or outside of the classroom)." Of the 101 responses, 9 specifically stated "none." Other responses included "nothing has made me more aware," "haven't really had any that I can think of," and "most of my environmental appreciation [sic] came from either before Colby or my year abroad." However, 167 respondents did not provide

any answer to this question. Perhaps they were lazy or maybe they have not had an experience at Colby that made them aware of their relationship with the environment.

Student Recommendations for Colby

The second qualitative open response question was "What can Colby do to further develop respect for the environment and sustainable living practices among students?" A total of 153 students provided responses to this question. The most common suggestion for Colby, included in 19 responses, was to create a general education requirement centered on the environment. "I believe an introductory environmental science course needs to be a distribution requirement to ensure the Colby students are educated on the current environmental crisis," stated one student. Another student agreed, "Colby could have a distribution requirement in environmental literacy. In my opinion it is just as important as an international and US diversity requirement." A third student suggested, "Put a wind turbine on Runnals. But also maybe an environmental distribution requirement."

The second most frequent suggestion for Colby was to implement an environmental wellness seminar; 16 students specifically including the phrase *wellness seminar* in their responses. Students recommended that Colby "Start environmental education earlier… have [sic] environmental wellness seminars for freshmen," and require wellness seminars "about respect for the environment and sustainable living." Another respondent reflected, "I think the sexual violence seminars are good but I think that environmental awareness sessions for freshman coming to a new place and how to be responsible at Colby [are] just as important."

Similar to wellness seminars, 12 respondents suggested that Colby implement environmental curriculum in freshman orientation. One student suggested, "integrate

environmental awareness with orientation (environmentalism is a selling point for Colby and we should do everything we can to make it a part of the Colby experience).” Another student recommended that the College “beef up LNT/environmental ed in COOT and the First Year Experience.”

In addition to these academic options, 10 respondents talked about expanding environmental curriculum into other majors. One student reflects, “I think environmental literacy should be better woven into the curriculum. I feel like I care a lot about the environment but would struggle to defend my ideas and speak intelligently about it.” Another student expresses, “ES majors have a great understanding and respect for the environment, but I think this information lacks in other disciplines… sustainable living practice information in other [courses] and in unexpected disciplines would give the entire student body a better respect for the environment and sustainable practices.”

The previous four categories of student recommendations were mentioned most frequently in survey responses. The categories included: creating an environmental general education requirement, adding an environmental wellness seminar, introducing sustainability during freshman orientation, and including sustainability in academic disciplines beyond Environmental Studies. These top four categories of student recommendations all call for increased educational opportunities at Colby regarding the environment. None of the most frequent responses focus on physical changes to the campus or improvement in student behaviors.

The next most popular suggestion for Colby, mentioned by nine respondents, was to improve composting awareness and abilities. Divesting from fossil fuels followed this suggestion, with 6 students recommendations. Other suggestions included improving recycling by emptying the overflowing bins more often or moving to single stream, providing incentives to live sustainably,

working out heating problems in dorms and classrooms, and featuring more environmental lecturers.

Discussion

The discussion of this paper includes an interpretation of quantitative results and then an interpretation of qualitative results. Each is explores the results as they relate to the literature and to student life at Colby. The next section uses these results to outline possible initiatives that Colby College could take to increase student environmental literacy. It concludes by reiterating the critical nature and potentially large-scale impact of educating all Colby students about the environmental crisis or failing to do so.

Interpretation of Quantitative Results

Survey results illuminated differences in students' attitudes, behaviors and EL across different academic disciplines at Colby.

We can infer from survey results that the environmental studies department is in fact leading to increased EL amongst students. With significantly higher scores than every other course of study in attitudes, behaviors, and EL, it is clear that academic experiences and the knowledge that comes with them do help achieve higher environmental literacy in students. While this finding may appear inconsistent with Quo-Cheng et al. (2014) and Goldman et al. (2014), who found that scientific coursework alone will not lead to sustained improvement in environmental literacy, it's important to note that the ES department at Colby provides students with a much broader realm of experiences than simply science classes. These experiences include, but are not limited to field trips, required speakers, required interdisciplinary coursework, experiential projects, class discussions, and relentless environmental curriculum. Increased environmental literacy in ES students is at least in part a result of a combination of these initiatives.

Overall attitude scores are significantly higher amongst Environmental Studies (ES) students than other students, followed by hard sciences. While hard sciences are not significantly different from the other disciplines (besides ES) in the attitudes results, the discipline does have significantly higher scores than the others when it comes to behavior. This could be because the survey question, "Do you plan to choose a career related to the environment?" was included in the behavior score. It is likely that hard science majors consider their career paths to be more related to the environment than, for example, a major in the social sciences might see theirs. As evidenced by Quo-Cheng et al. (2014) and Goldman et al. (2014), it is unlikely that strictly scientific knowledge led to an increase in environmental behaviors in students.

Our finding that hard science students who come to Colby with low environmental awareness maintain low EL scores relative to their peers also supports this. While ES students with low HS awareness have current EL scores comparable to their peers with high HS awareness, the hard science curriculum at Colby does not bring students with low awareness up to par with their peers. This may be due to a lack of intentional environmental curriculum within hard science courses and/or fewer academic opportunities that are interdisciplinary or experiential in nature.

Although the survey found such drastic differences between ES students and other students, the majority of Colby student respondents do have environmentally leaning attitudes. For example, 75% of student respondents are at least *somewhat* concerned about climate change and 50% of students think about the effects of their actions on the environment at least *most of the time.* Interestingly, 43% of students alter their actions out of concern for the environment *most of the time* as well. This difference between attitude and behavior is not as stark as expected or seen in the literature. Perhaps this is because the questions were worded similarly and

followed each other on the survey so respondents may have put the same answer for each. Or, perhaps Colby students are bridging the gap between attitude and behavior. On the other hand, while exactly 50% of students surveyed are *quite a bit* concerned about climate change, only 13% regularly participate in environmental clubs on campus. This could be due to a number of factors: perhaps students are too busy for environmental clubs, perceive them as ineffective, or have trouble translating their concern about climate change into behavior.

An additional finding is that an impressive 84% of student respondents agree that colleges have an obligation to develop student respect for the environment and commitment to sustainable living. This is no small majority and highlights an overwhelming support from the student body for education about the environment at the college level. This is consistent with results from the qualitative section that show frequent student suggestions to implement sustainability into the curriculum.

Finally, a brief note about the limitations of this study: The sample size of 266 respondents is large, however it should be noted that students interested in the environment were probably more likely to take the survey. Thus, the student sample displayed in these results may be more environmentally literate than a truly random sample of 266 Colby students. Additionally because this survey clearly took a favorable viewpoint towards environmentalism, it is possible that students strived to 'look good' on it and rated themselves as actually more environmentally literate than they are in reality. Lastly, the researcher is currently a female senior at Colby College, which may have contributed to the higher incidence of survey respondents who were seniors and/or female.

Interpretation of Qualitative Results

Qualitative responses to the question, "Please list/describe any experiences you have had at Colby that made you aware of your relationship with the environment (inside or outside of the classroom)," were incredibly informative. Colby puts in an admirable amount of effort into sustainability efforts, so the patterns seen in responses to this question were of interest. First, very few responses included anything about physical advances on campus like carbon neutrality or LEED Certifications. Through a survey question that asked students which sustainable practices on campus they are aware of, we know most students know about Colby's carbon neutrality, biomass plant, composting practices, and LEED certification. However, answers to the question about experiences at Colby reveal that initiatives improving Colby's physical environmental impact do not lead to environmental literacy in Colby's students. Instead, students in the survey wrote about receiving environmental awareness from experiences like COOT, COC trips, and simply being outside in Maine. These experiences were listed with the most frequency. This finding is consistent with Charles Roth's definitions of an environmentally literate citizen and with David Orr's call for incorporating the outdoors in education. The best way to increase respect for the environment is to get outside and establish a sense of place. People will not fight of sacrifice for something they do not have a relationship with.

Club participation and initiatives was also frequently cited by respondents as a means of becoming aware of the environment. 31 students referenced specific club initiatives on campus, while 23 students talked about personal participation in a club. This finding shows the effectiveness (at least to some extent) of environmental clubs on campus. However, compared to the respondent pool of 266 students, 198 of whom answered this question, 23 is a low participation rate for environmental clubs.

Class experiences also contributed to environmental awareness in 37 student responses to this question. However, when asked in a separate question to list courses taken at Colby that contributed to a student's environmental awareness, 187 listed at least one class. This question was asked at the beginning of the survey, so perhaps later on when students were asked to describe experiences at Colby that led to environmental awareness, they felt that they had already talked about classes. For example, one respondent simply said, "All the classes listed above," referencing the classes listed earlier in the survey. Of the 37 responses to the *describe experiences* question, many respondents listed one specific class and praised the discussion aspect of the classroom experience. This makes sense because discussion allows for the formation of personal attitudes and ethics to a greater degree than learning from a lecture or textbook does. In fact, 18 respondents cited conversations with friends as experiences that made them aware of their relationship with the environment. Overall though, further research would be helpful to gain a clearly understanding of how courses contribute to environmental literacy, and more specifically, what type of classroom experiences create long term environmental literacy in students.

Students were also asked the qualitative question, "What can Colby do to further develop respect for the environment and sustainable living practices among students?" When student suggestions were grouped into categories, the top four most frequently cited suggestions all involved creating more academic opportunities for student learning. 19 students recommended instating an environmental literacy distribution requirement, 16 students suggested a wellness seminar, 12 students talked about implementing sustainability into freshman orientation curriculum, and 10 students proposed expanding environmental curriculum across majors. This pattern illuminates a student demand for environmental education opportunities. Furthermore,

many students used the words *requirement* or *mandatory* in their suggestion. Like one student states, “Make it a force to be reckoned and make it mandatory for students to get involved. If not, even I wouldn't do it.” After all, this is a school and the purpose of education is to prepare students for success in the world. Our world happens to be reaching a crisis of proportions never before seen by humans. Furthermore, as David Orr reminds us, “This is not the work of ignorant people. Rather it is largely the results of work by people with BA’s, BSs, LLBs, MBAs, and PhDs,” (p. 7). Never before has the need for an interdisciplinary liberal arts education that includes environmental issues been more imperative.

Implications for Colby

The starkly significant difference between ES students’ environmental literacy scores and other majors’ scores provides clear evidence that Colby is not educating all students to be environmentally literate. Colby certainly has made substantial environmental strides in regard to physical buildings and carbon emissions on campus. However, the College has a responsibility to its students. Colby is an elite college and it’s graduates will be the doers, makers, and changers of influential world organizations, governments, and corporations. Do we need more economists who have never thought about the biological cost of resources? Do we need politicians who respond to money over science? An environmental education is no longer a trend or a political issue. It is the difference between humans taking the necessary steps to survive (and thrive) in the coming years or remaining complacent and continuing to destroy the earth that we rely on in exchange for short-term gains.

The literature reviewed of this project and the student survey responses provide the College with ample suggestions of ways to move forward. One simple way to educate all

students about the environment is to implement an environmental distribution requirement. Colby already has nine course distribution requirements, two of which are Natural Science (one Lab and one Non-Lab). Without displacing any other distribution requirement or increasing the number of requirements for students, the non-lab Natural Science requirement could become a sustainability requirement. Especially for non-science majors trying to fulfill the non-lab requirement, a class outlining the environmental crisis would be much more practical throughout life than a chemistry course.

It would not be difficult in theory for the College to agree to implement an environmental distribution requirement. First, an environmental requirement could replace the Natural Science Non-Lab requirement without disrupting any other requirements. Second, qualitative findings in this study show that students are asking for the opportunity to learn about the environmental crisis. And third, Colby has already committed to "nurturing environmental awareness through its academic program," in its summary of values. The words exist; all that is missing is the logistics of actually nurturing environmental awareness. More professors would likely need to be hired or some professors would need to receive more education. An environmental literacy requirement may need a dry run as a Janplan course. It's worth it though. The world *needs* environmentally literate people and we are in crunch time. In many ways, higher education dictates cultural norms and priorities. The general population is not likely to suddenly become sustainable without leaders who prioritize the health of the earth. Without higher education teaching environmental literacy, these leaders will seldom exist. Our peers at Middlebury University, Furman University, and University of Georgia all have environmental distribution requirements. Colby has been an environmental pioneer for years; however, we will not remain a leading environmental college if we fail to educate all students about the environmental crisis.

If not a distribution requirement, Colby could at least create an *Introduction to the Environmental Crisis* type of course. Currently, there is no course that a non-ES major could take to enhance their general understanding and personal obligation to the environment. The ES course "Introduction to Environmental Studies" is notoriously difficult, and also lecture based - it does not incorporate much discussion or participatory learning beyond a research project. In essence, it is a tough introductory course meant to set the tone for a challenging major. It is not a course that a student who is casually interested in educating him or herself about the environmental crisis would take. Colby could easily create a course that touched on environmentalism from philosophical, economic, political, and social justice standpoints in an effort to educate non-ES students about the environment. This course would likely be well received throughout the student body and could be a highly impactful academic experience for many students.

Other ways to reach the entire student body include incorporating sustainability into freshmen orientation or wellness seminars. This is certainly do-able and is actually already in the works as a result of this research study. These steps are crucial because they highlight Colby's commitment to the environment in the eyes of freshman, who are coming to Maine from hundreds of different backgrounds. Small steps like environmental wellness seminars are also important because they contribute to the greater cultural value of respect for the environment at Colby.

In the survey, ten students also recommended that Colby integrate sustainability into majors beyond ES. This could take a variety of forms. One idea would be to simply encourage all professors to relate some of their own course material to the environment a few times a semester. Another option could be to have an environmental requirement within each major's

own requirements. For example, history majors would have to take a course like *Interactions Between Humans and the Environment throughout History.* Global studies majors could study *Global Impacts of Climate Change.* Nearly every major at Colby already has at least one course that is somewhat related to the environment. Enhancing the courses already provided and making them mandatory to all majors could be highly beneficial to students.

Further research is needed at Colby to understand what specific initiatives lead to EL, especially in regard to academics. In essence, "what subject materials, types of pedagogies, and/or level of requirement would effectively educate students across the board to be environmentally literate?"

Additionally, the results of this study showed that students in the ES department had higher EL scores than their peers, but when broken down further, it seems as though student environmental awareness prior to coming to Colby is a predictor of student EL scores at Colby. The question here is essentially, "What value added does a Colby education give to student levels of environmental literacy?" And furthermore, "How can we improve this value added for all students, not just ES majors?

The importance of environmental literacy at this moment in history cannot be understated. The earth needs it, and thus, people need it too. Waiting for peer institutions to take the lead or assuming that environmentalism will gradually incorporate itself into the curriculum is irresponsible and impractical due to the pertinent nature of this crisis. Furthermore, as illuminated by the 2010 survey of United Nations Global Compact CEOs, sustainability is "truly top of the mind for CEOs around the world" and there is a "critical need for business schools and education systems to focus on developing the next generation… to manage sustainability issues as an integral part of the way they think about business," (p.49). Failing to provide graduates

with any environmental education is essentially denying them the skills they need to succeed in modern organizations. The need for people who understand the crisis and have the intellectual tools to deal with it will only increase as time goes on. The institute of higher education has a moral obligation to meet this need.

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Colby

Environmental Literacy Survey

Thank you for participating in this survey. You are not required to answer any of the following questions, but full participation is appreciated. Please know that 100% anonymity is guaranteed. Qualtrics is survey software used by Colby College and will not record any personal information about you. Please strive to answer as completely and honestly as possible. You are able to skip any questions that make you uncomfortable, but the data has increased value if the survey is completely filled out.

The purpose of this survey is to contribute to a Senior Honors Thesis Project that is assessing environmental literacy amongst students on Colby's campus.

Before beginning, please read the following statement taken directly from the values section of Colby's 2014-2015 Catalog:

"Colby is committed to nurturing environmental awareness through its academic program as well as through its activities on campus and beyond. As a local and global environmental citizen, the College adheres to the core values of respect for the environment and sustainable living. Colby seeks to lead by example and fosters morally responsible environmental stewardship. Environmentally safe practices inform and guide campus strategic planning, decision making, and daily operations. We urge community members to recognize personal and institutional responsibilities for reducing impact on the local and global environment. Finally, we recognize that achieving environmental sustainability will be an ongoing challenge that evolves as we become more aware and educated as a community."

1) What is your class year?

- ○ 2018
- ○ 2017
- ○ 2016
- ○ 2015

2) What is your gender?

- ○ Male
- ○ Female
- ○ Other

3) Please select your major:

Major:

Add an additional major:

Second Major:

Please select your minor:

Minor:

Add an additional minor:

Second Minor:

4) List any courses you have taken at Colby that helped you develop respect for the environment and a commitment to sustainable living:

5) Please list/describe any experiences you have had at Colby that made you aware of your relationship with the environment (inside or outside of the classroom):

6) In high school, how aware were you of environmental practices and problems?

Unaware	Kind of aware	Very Aware	Extremely Aware
○	○	○	○

7) Colby has implemented the following sustainable practices on campus. Please select the ones you are aware of.

- ☐ Reached carbon neutrality
- ☐ Receives energy from biomass
- ☐ Composts dining hall food waste
- ☐ Holds a RESCUE Sale at the beginning of each year
- ☐ Has compost bins available for students' personal use
- ☐ Holds monthly meetings with the college's Environmental Advisory Group
- ☐ Requires that all new construction be LE ED Certified
- ☐ Has established an Office of Sustainability

8) Please identify any of the following environmental initiatives you have participated in at Colby:

- [ ] Regularly use re-usable water bottles and/or coffee mugs
- [ ] Celebrate Earth Day
- [ ] Recycle trash regularly
- [ ] Regularly attend meetings of on campus environmental organizations/clubs
- [ ] Participate in Meatless Monday
- [ ] Regularly purchase local food and/or goods
- [ ] Donate to the RESCUE sale and/or Free Cycle
- [ ] Other

9) To what extent are you concerned about climate change?

○ None ○ A Little ○ Some ○ Quite a Bit ○ An Extreme Amount

10) How often do you think about the effects of your actions on the environment?

○ Never ○ Rarely ○ Sometimes ○ Most of the Time ○ Very Often

11) How often do you alter your actions out of concern for the environment?

○ Never ○ Rarely ○ Sometimes ○ Most of the Time ○ Very Often

12) How strongly do you agree/disagree with the statement: "Colleges and universities have an obligation to help students develop respect for the environment and a commitment to sustainable living"?

○ Strongly Disagree ○ Disagree ○ Neither Agree nor Disagree ○ Agree ○ Strongly Agree

13) Do you feel as though your Colby education has prepared you to (select all that apply):

- [ ] Casually converse about environmental awareness?
- [ ] Talk intelligently with friends about the environmental crisis?
- [ ] Defend your beliefs about the environmental crisis?
- [ ] Convince a stranger that the environmental crisis is real?

14) What can Colby do to further develop respect for the environment and sustainable living practices among students?

15) Do you plan to choose a career path related to the environment?

○ Yes

○ Maybe

○ No

References

American College & University Presidents' Climate Commitment. (2007). Retrieved December 31, 2014, from http://www.presidentsclimatecommitment.org/about/mission-history

America's Top Colleges. (n.d.). Retrieved December 31, 2014, from http://www.forbes.com/top-colleges/list/

Anderson, M. W., Teisl, M. F., Criner, G. K., Tisher, S., Smith, S., Hunter, M. L., & ... Bicknell, E. (2007). Attitude Changes of Undergraduate University Students in General Education Courses. Journal Of General Education, 56(2), 149-168.

Campaign for Environmental Literacy. (n.d.). *What is Environmental Literacy?* Retrieved May 4, 2015, from http://www.fundee.org/facts/envlit/whatisenvlit.htm

Colby Plan: Mission and Precepts. Colby College Catalogue 2014-2015. (n.d.). Retrieved December 31, 2014, from http://www.colby.edu/catalogue/front-of-catalogue/summary-of-colby-values/

Fieselman, L., & Lindquist, E. (2013). The Emerging Environmental Sustainability Program at Meredith College. In L. F. Johnston (Ed.), *Higher education for sustainability: Cases, challenges, and opportunities from across the curriculum* (11-28). New York, NY: Routledge.

Furman University Catalog 2014-2015. (2014). Retrieved from http://www.furman.edu/academics/catalog/Documents/2014-2015_catalog.pdf

Global Climate Change: Evidence. (n.d.). Retrieved December 31, 2014, from http://climate.nasa.gov/evidence/

Global Warming and Coral Reefs - National Wildlife Federation. (n.d.). Retrieved December 31, 2014, from http://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/Effects-on-Wildlife-and-Habitat/Coral-Reefs.aspx

Goldman, D., Yavetz, B., & Pe'er, S. (2014). Student Teachers' Attainment of Studies. Environmental Literacy in Relation to their Disciplinary Major during Undergraduate International Journal Of Environmental & Science Education, 9(4), 369-383. doi:10.12973/ijese.2014.222a

Green Colby. (n.d.). Retrieved December 31, 2014, from http://www.colby.edu/green/

Halfacre, A., Bryne, J., Horhota, M., Kransteuber, K., Trombulak, S., DeKnight, B.,

Andersen, B., & Jenks-Jay, N. (2013). Shaping Sustainability at Furman and Middlebury. In L. F. Johnston (Ed.), *Higher education for sustainability: Cases, challenges, and opportunities from across the curriculum* (185-200). New York, NY: Routledge.

History of the ES Program. (n.d.). Retrieved December 31, 2014, from http://www.colby.edu/environmentalstudies/about/history-of-the-es-program/

Johnston, D., & Johnston, L. (2013). What's required to take EfS to the next level?. In L. F. Johnston (Ed.), *Higher education for sustainability: Cases, challenges, and opportunities from across the curriculum* (185-200). New York, NY: Routledge.

Karim, S., Sriskandarajah, N., & Heiter, A. (2013). Systems Study of an International Master's Program. In L. F. Johnston (Ed.), *Higher education for sustainability: Cases, challenges, and opportunities from across the curriculum* (63-78). New York, NY: Routledge.

Lacy, P., Cooper, T., Hayward, R., & Neuberger, L. (2010). A new era of sustainability: UN Global Compact-Accenture CEO Study 2010.

Moody, G., Alkaff, H., & Garrison, D. (2005). Assessing the Environmental Literacy Requirement at the University of Georgia. Journal Of Environmental Education, 36(4), 3-9.

Nair, I., Jones, S., & White, J. (2002). A Curriculum to Enhance Environmental Literacy. Journal Of Engineering Education, 91(1), 57-67.

National Center for Educational Statistics (NCES). (n.d.). Retrieved December 31, 2014, from http://nces.ed.gov/fastfacts/display.asp?id=84

News, Resources, Events, and Assessment Tools for the Campus Sustainability Community. (3013, January 1). Retrieved December 31, 2014, from http://www.aashe.org/

North American Association for Environmental Education (NAAEE). (2011). Retrieved May 4, 2015, from https://www.naaee.net/what-is-ee

Orr, D. (2004). Earth in mind: On education, environment, and the human prospect. Washington, DC: Island Press.

Plumwood, V. (1993). *Feminism and the Mastery of Nature*. New York, NY: Routledge.

Quo-Cheng, S., Ming-Liang, L., Ko-Yu, S., Chia-Chen, W., Yi-Lin, J., & Li-Ting, H.

(2014). Changing behaviors: Does knowledge matter? A Structural Equation Modeling study on green building literacy of undergraduates in Taiwan. Sustainable Environment Research, 24(3), 173-183.

Redman, C. & Wiek, A. (2013). Sustainability as a transformation in education. In L. F. Johnston (Ed.), *Higher education for sustainability: Cases, challenges, and opportunities from across the curriculum* (214-222). New York, NY: Routledge.

Report and Declaration of The Presidents' Conference. (1990, October 7). Retrieved December 31, 2014, from http://www.ulsf.org/programs_talloires_report.html

Roth, C. E. (1968). Curriculum Overview for Developing Environmentally Literate Citizens.

Roth, C. E. (1992). Environmental Literacy: Its Roots, Evolution and Directions in the 1990s.

Rowland, P. (2013). Foreword. In L. F. Johnston (Ed.), *Higher education for sustainability: Cases, challenges, and opportunities from across the curriculum* (VIII – X). New York, NY: Routledge.

Shaping the Education of Tomorrow 2012 Report on the UN Decade of Education for Sustainable Development, Abridged. (2012). *UN Decade for Sustainable Development*. Retrieved from http://unesdoc.unesco.org/images/0021/002166/216606e.pdf

STARS: Colby College Waterville. (2014, December 12). Retrieved December 31, 2014, from https://stars.aashe.org/institutions/colby-college-me/report/2014-12-12/

University of Maine. (2014). *Academics - General Education Requirements.* Retrieved December 31, 2014, from http://umaine.edu/handbook/academics/general-education-requirements/

Summary of Colby Values · Colby College Catalogue 2014-2015. (n.d.). Retrieved December 31, 2014, from http://www.colby.edu/catalogue/front-of-catalogue/summary-of-colby-values/

Sustainability UGA. (2013, January 1). Retrieved December 31, 2014, from http://sustainability.uga.edu/get-involved/faculty/faculty-sustainability-breakfast/

Talloires Declaration. (2014, July 1). Retrieved December 31, 2014, from http://www.ulsf.org/programs_talloires_signatories.html

Teisl, M. F., Anderson, M. W., Noblet, C. L., Criner, G. K., Rubin, J., & Dalton, T.

(2011). Are Environmental Professors Unbalanced? Evidence from the Field. *Journal Of Environmental Education*, 42(2), 67-83.

Teksoz, G., Sahin, E., & Tekkaya-Oztekin, C. (2012). Modeling Environmental Literacy of University Students. Journal Of Science Education And Technology, 21(1), 157-166.

UGA Office of Sustainability. (n.d.). Retrieved December 29, 2014, from http://sustainability.uga.edu/

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2014). Retrieved December 31, 2014, from http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/education-for-sustainable-development/

United States Environmental Protection Agency. (2015). Retrieved May 4, 2015, from http://www2.epa.gov/education/what-environmental-education

Weir, K. (2011, November 29). Boots On the Ground. Retrieved December 31, 2014, from http://www.colby.edu/magazine/boots-on-the-ground/

Wright, Tarah. (2013). Steppling up to the challenge – the Dalhousie experience. In L. F. Johnston (Ed.), *Higher education for sustainability: Cases, challenges, and opportunities from across the curriculum* (201-213). New York, NY: Routledge.