Duke University and the Nicholas School: Encouraging today's youth through environmental education

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Abstract

Environmental education programs and curriculum have been a crucial part of earth and science education since the mid-1970s. With the increasing scope of environmental issues in the US and worldwide, it is important to prepare our youth to solve pressing environmental problems. This study documents K-12 environmental education initiatives in Durham county public schools sponsored by the Duke University community, including and earth science departments and the Nicholas School of the Environment. The scope, pedagogical approach, process of development, and challenges of these initiatives are noted. Moreover, this study offers recommendations for both Duke and the Nicholas School of the Environment based on current academic literature and similar outreach programs at other universities such as the inclusion of training and enhanced professional development for in-service teachers and increased emphasis on service-learning and nature based instructional approaches.
**Introduction**

**The Formation of Duke University and the Nicholas School**

Originally founded as a college to help young men in their religious journey, the Durham campus of Trinity College quickly became one of the South’s most prestigious universities as it transformed into what is now known as Duke University in 1924 (King, 2002). With the additions of a law school, business school, and medical school, Duke University quickly became a powerhouse of information disseminated to the global academic community as well as the local community. Realizing that there was a significant gap in communication between the university and Durham area, the Office of Durham and Regional Affairs was established in order to foster more collaborative efforts between the two (https://community.duke.edu).

To facilitate the Office of Durham and Regional Affairs’ mission to provide advocacy services to the Durham community as well as economic development, the Duke Durham Neighborhood Partnership (DDNP) was created in 1996. (https://community.duke.edu) The Duke Durham Neighborhood Partnership focuses on the advancement of 12 communities in close proximity of the university. Under this partnership, a number of programs and initiative are developed to address the quality of health, educational achievement, as well as a number of other aspect that impact one’s quality of life. As a part of its mission to educate others, DDNP has developed a science and technology program for youth to address the issue of underrepresented minorities and females in the field of science (BOOST, Building Opportunities and Overtures in Science and Technology). This program and others environmental education programs like it sponsored by Duke and the Nicholas School are included in this study.

The Nicholas School of the Environment was established in 1991 to address the interests of students within the entire realm of environmental sciences. The Nicholas School functions to create knowledge, create global leaders, and to forge a sustainable future (http://www.nicholas.duke.edu/about/mission-statement). As a part of the schools commitment to advancing the ideas of a clean and healthy environment, the Nicholas School has worked to spread the principles of environmental education (nicholas.duke.edu/about/history/).
This study serves as an investigation of the environmental education outreach efforts of Duke University and the Nicholas School of the Environment for K-12 students in the Durham area. As a forward thinking research based university that has openly expressed its commitment to studying but preserving the environment, one would believe that Duke has fulfilled this goal by not only educating its enrolled students, but the pupils of grades K-12. Because not all environmental education outreach at the University is completed by the Nicholas School of the Environment, work done at large by the Durham University community and staff have been compiled in this study.

As higher education institutions continue to be recognized for their efforts in creating solutions to critical issues around the world, it is imperative to be able to understand and describe how Duke University may influence the work of future generations in the realm of environmental science. Before discussing the environmental education opportunities made available at Duke University and the Nicholas School of the Environment, one must first understand the importance on environmental education in the past and present of society.

**Background**

**The Development of Environmental Education**

After the 1972 United Nations Conference on Human Environment in Stockholm, the topic of Environmental Education was introduced to the public (Venkataraman, 2008). Attendees of the Human Environment Conference realized that by providing environmental education curricula, positive changes could be made to the world (Venkataraman, 2008). Many agreed that educational efforts would result in a more educated and environmentally aware public that would work as a community to protect and improve the environment (Venkataraman, 2008). As the awareness of environmental issues has grown, so has the environmental education field (Venkataraman, 2008). There are now universities, colleges, and academic departments devoted to spreading the knowledge of environmental issues and to educating the public.

Although environmental education programs have been growing throughout the nation, critics would argue that there is still room for improvement in practice and in theory. Recently
many educators, scientists, field experts have commented on how they believe our (US) current approaches and practices of environmental education to be unsuccessful. In their book *The Failure of Environmental Education*, Saylan and Blumstein (2007) suggest that current environmental educational efforts have fallen short of meeting its goal. Saylan and Blumstein (2007) suggest that for our society to benefit from the instruction of environmental education, individuals must be able to observe the relationship between their actions and the state/health of the environment. To ensure that our educational systems are in fact having a positive impact on how individuals view the environment, Saylan and Blumstein (2007) have further suggested that our educators implement evidence-based approaches to environmental education. Evidence-based educational approaches measure an individual’s level of environmental literacy and action before and after being exposed to quality environmental instruction (Saylan and Blumstein, 2007). Along with Saylan and Blumstein, Sanera and Shaw have openly expressed their concerns about current environmental education instruction (Smith, 2005). In their textual investigation about environmental issues, Sanera and Shaw focused on middle and high school health science and geography literature (Smith, 2005). Sanera and Shaw reported that much of the focus within this literature was on the extreme negative impacts the environment will face if society does not change their behavior (Smith 2005). Resulting from extensive research, critics have identified several critical factors that attribute to their disbelief in the success of environmental education practice and curriculum: neglect to focus on science and economics of environmental issues, instructors not fully prepared to teach environmental information, and errors within environmental education materials to name a few (Independent commission on Environmental education, 1997 found in Smith, 2005). In spite of these criticisms, environmental education efforts are still utilized to increases the public and youth’s awareness of pressing environmental issues.

**Environmental Education Instructional Approaches**

When studying environmental education programs for the youth, it is very easy to note that not all environmental education programs are alike. There are several different instructional approaches used to present scientific information. Discussed below, are a few
approaches used to teach and introduce students to the earth and environmental sciences. One objective of this study is to identify whether or not the environmental programs/activities made available to students in grades K-12 by Duke and the Nicholas School employ any of these approaches. Instructional approaches about the earth and environmental sciences in practice are not limited to those discussed in this study.

**Place-based Instruction**

To increase student awareness and participation in solving local environmental issues, place-based education is now occurring in several cities, towns, and states across the U.S. Placed–based education allows students to learn beyond the classroom with the help of various community members to find solutions to real life problems (Sobel, 2005). Schoolyards, forests, and gardens are not only places for exploration but also the environment in which students learn under place-based instruction (National Park Services, The Benefits of Place-Based Education). Students that participate in place-based instruction often gain valuable professional development skills because of their interactions with local professional within the field of study addressed by the program. University led place-based instruction introduces students to university staff and provided with connections to individuals that may help them further their educational careers (Brumbach and Ridenour, 2003).

As an initiative under the supervision of the Antioch New England Institute at Antioch University New England, The Center for Place-based Education offers opportunities for those interested in getting involved in environmental education programs that are both service-learning and place based (Antioch University, 2012). Community groups and members may collaborate to help students understand what it means to be good stewards within the community. One example of a place-based program that the center provides is CO-SEED, the Community-based School Environmental Education project (Antioch University, 2012). This three-year initiative helps develop place-based and community-based curriculum. CO-SEED guidelines have helped students to generate several projects. Students participating in the Co-SEED program work together to create park guides, maps and other representations of nature and art (Antioch University, 2012).
**Service Learning**

Service learning is the act of instruction and learning through civic engagement (Billig, 2000). Students are able to take information gained in the classroom and apply it within their communities. Key components of service-learning education are to find and address issues that are both personally relevant to the students and are of great importance to the community (National Youth Leadership Council). In terms of students in grades K-12, courses, extracurricular activities and whole grade departments have collaborated to provide students with opportunities where they are able to have both positive and direct impacts on the communities in which they live (Billig, 2000).

Schools have used service-learning instruction for many years. Reports suggest that the benefits of participating in service-learning activities are improved problem-solving skills of students, an increased sense of responsibility to the community, increased academic achievement of participants, as well as a long list of others (Billig, 2000). As knowledge about our environment and the linkage between human interactions and degradation, becomes increasingly available, service-learning opportunities may continue to grow as they are used to shape students’ interest and involvement in solving environmental issues.

As a means to teach sixth grade students about the importance of reusing and recycling materials, administration at six Hebron, Nebraska schools have implemented a program in which students, make flowerpots out of recycled paper. Instructors teach their pupils in the participating classrooms about the many ways they may reuse and recycle everyday materials. Students then construct flowerpots from recycled paper. In order to provide students with an opportunity to engage with others in their community through the construction of their flowerpots, participating sixth grade students take their flowerpots to local elders of their “adopted grandparents” in assisted care facilities throughout the community (EPA, Service-Learning).
**Nature-based**

Another approach to environmental education involves how individuals measure the value of nature in their lives. Known as nature connection or nature connectedness, several individuals have developed scales and measures to determine nature connectedness. These measures include Mayer and Faratz’s Connection to Nature Scale, Clayton’s Environmental Identity Scale, and Nibet et al’s Nature Relatedness (Nibet et al, 2008). In terms of education, nature connection or, for this study, nature-based education helps students become acquainted with the environment and natural materials (naturebasededucation.com, 2011) through observation and exploratory activities.

Most of the work done by the Wilderness Awareness School (WAS) utilizes nature-based instruction. The Wilderness Awareness School has several camps and courses for both children and adults that focus on the natural environment. During their camp and field expeditions, participants not only gain information about the wilderness regarding survival but also nature awareness as well. Utilizing its own unique “curriculum”, WAS introduces students to nature. Coyote Mentoring is a combination of both traditional and ancient methodologies used to instruct others about the natural environment (willdernessawareness.org, 2013). Students are able to share their ideas and experiences openly with a small group as well as receive one-on-one attention from camp leaders. WAS has stated that their camp helps students to become more confident in themselves. It is through the sharing of ideas, experiences, and the ability to be creative throughout the duration of camps and programs that WAS attributes the increases in their students’ confidence and sense of empowerment (wildernessawareness.org, 2013).

**Researched-Based**

A more structured approach of teaching the earth and environmental sciences is through research-based methods. In research-based education, students must complete all aspects of the research process: developing a research question, collecting data, analyzing data, and reporting results (Jungmann, 2011). Under this approach, students begin to think as scientists, questioning the world around them and solving real life problems (Jungmann, 2011).
The University of California at Berkeley’s FOSS, Full Option Science System, is a good example of research-based science instruction. There are a number of modules and courses for students ranging from kindergarten to eighth grade. Middle school students may participate in earth history courses that encourage them to develop questions that they will answer through the research process (http://lhsfoss.org/, 2013). As previously stated, FOSS also encourages the curiosity of young minds, kindergarten students. Although they are too young to understand the research process and to develop eloquent questions to examine natural phenomenon, goals for participating kindergarten students include increasing use of observation skills, the ability to compare geometry and natural shapes (leaves and flowers), and the ability to care for a plant (http://lhsfoss.org/, 2013).

**Environmental Ethics/Philosophies**

As students and adults learn about the environment either in formal or non-formal settings, they may form their own beliefs about what the environment is and how invested they are to preserving it. Because there are numerous ways to conceptualize the environment and its intrinsic value, there are consequently a number of environmental philosophies. Environmental philosophies and ethics range from individuals’ beliefs that all living organisms, including humans, are significant and have a good to offer one another in their existence (ecocentrism) to beliefs that humans are the superior species and that environmental issues and decision-making should be framed in a manner that first benefits humans (anthropocentrism) (Lindenmeyer and Burgman, 2005). To help individuals define and articulate where their values lie within the environment, a number of individuals have designed evaluations and scales grounded in the various environmental ethics and philosophies.

One instrument that has been widely used for many years is the New Environmental Paradigm (NEP), developed by Dunal and Van Lier in the 1970s. Constructed much like a survey, respondents of the NEP scale record the degree to which they agree or disagree with the twelve items listed on the scale (Dunlap and Van Lier, 2008). Items found on the list measure and reflect emphasis and awareness of environmental issues such as growth limits, nature balance, and anthropocentrism. Based on their responses, participants determine their
view and value of environmental regulation support for environmental programing, and environmental behaviors (Dunlap and Van Lier, 2008). In the late 1990’s Dunlap and Van Lier collaborated with Mertig and Jones to revise their New Environmental Paradigm scale (Dunlap et al, 2000). The New Ecological Paradigm Scale was developed to address the shortcomings of the New Environmental Scale by including: the use of more pro and anti-New Environmental Paradigm items, a greater emphasis on worldwide views of ecology, and the use of more up to date terminology (Dunlap et al, 2000). Not only has this scale been revised, there are a number of scales similar to the New Environmental Paradigm and New Ecological Paradigm in use to help individuals determine their pro or anti-environmental beliefs.

This study also identifies the underlying environmental philosophies used or expressed in environmental outreach activities by Duke and the Nicholas School.

**Methods**

The methods and procedures for data collection within this study borrows from both descriptive and comparative case study inquiry. When developing a case study, several key components must be included. The most important component of a case study is the case or problem/phenomena (Neale et al, 2006). For this study, the phenomenon or case has been identified as environmental outreach practices. Another key aspect of a case study is that it is bounded by some measurable or observable component (Creswell, 1998). Programs and activities discussed in this study either are currently in practice or have been recently developed or discontinued in the last year.

The larger purpose of this research is to serve as a descriptive case study. By identifying programs, describing the pedagogical approaches and target audiences, and briefly discussing the process of development within Duke and Nicholas School K-12 environmental education programs, the goal of developing a descriptive case study is achieved.

To determine how the outreach efforts of Duke and the Nicholas School measure in comparison to other universities, this study also functions as an intrinsic descriptive comparative case study. I have chosen to depict my case study in this manner because it will describe the outreach actions of two (or more) university as a comparison to determine if Duke University’s efforts
meet the standard of other universities. The word intrinsic implies that the case or problem in question is of more interest to the researcher than of the general public (Baxter and Jack, 2008). Therefore, it is necessary to call this work an intrinsic descriptive comparison case study. Case studies generally use various methods of data collection in order to get detailed information about the activities in question. As discussed below, I used two distinct approaches to the collection of data for this study.

**Interviews**

To determine the various types of K-12 environmental education outreach provided by Duke University and the Nicholas School for youth of the Durham area, I interviewed a number of individuals on campus. I chose the interview method of data collection because it functions as a “conversation with purpose” (Dexter 1970 p.136). Interviews allow for the free-flowing exchange of information (Holstein and Gubrium, 1997). More specifically, with the use of semi-structured interviews, researchers may explore the use of probes in order to gain details about subject matter, more clarification about actions, and simply increased explanation about actions taken. I selected some individuals or research participants based on their job titles and affiliation to outreach organizations on campus; others were suggested to me using network or referral sampling at the completion of an interview. Network sampling, much like snowball sampling, utilizes current research participants to recruit future participants. Unlike snowball sampling, network sampling elicits research participants across networking lines rather than a top down approach used in snowball sampling (Given, 2008).

Utilizing semi-structured interview methods, participating individuals were asked a number of questions both pre and non-preselected about the existence, development, and challenges/benefits of EE programs for grades K-12 in Durham. Refer to Appendix A to see the interview guide. To analyze the information from the interviews, I employed the use of selective transcription, paying attention to only information and details I found particularly interesting to this study. Using this method of analysis saves valuable time and resources (Davidson, 2006).
In addition to selective transcription, I used Nvivo 10 to identify characteristics within Duke and the Nicholas School’s environmental education outreach that borrows from the four instructional approaches previously discussed. Nvivo 10 is a qualitative data analysis program that allows the researcher to explore and identify themes and relationships within data. Using this software, I coded interviews, articles, and web pages based on the presence or use of elements present in the environmental education approaches selected for this study. I used a similar coding structure to identify the key elements in each instructional approach.

**Material Collection**

In addition to interviews, I used in print and online information to enrich the data that was collected via interview. The benefits of using previously constructed data is that they are readily available (Merriam, 2001). Another benefit of the use of documents both written and online is that researcher excludes or limits him or herself from altering the data by including bias (Merriam, 2001). I have been able to avoid this by using published documents authored by other individuals.

To enhance information or supplement for interviews, I collected program information and descriptions from various online databases and documents. Information gathered from these sources included mission statements, increased detail of program description, and contact information. I utilized the Ncapture tool within Nvivo10 to make portable document format files (PDFs) of web pages. Once the PDFs were imported into Nvivo, I could then code the documents for various themes or nodes. I based nodes on the components within the instructional approaches discussed in this study and located in the Appendix B. I used this information for both this written report and the associated website for this study.

**Accompanying Website**

To make the information I have gather about K-12 environmental programs and activities at Duke and the Nicholas School available to the public, I constructed a wordpress site. Teacher, parents, and older students can visit the site and gain information about Duke’s K-12 environmental outreach as well as information about the instructional approaches discuss...
in this study and other programs that utilize these methods of instruction in practice. Please visit [http://sites.duke.edu/durhamenvironmentaleducation/](http://sites.duke.edu/durhamenvironmentaleducation/) to view the site.

**Results**

Throughout the data collection process, I contacted approximately seventeen individuals as well as sent a mass email to the Nicholas School. Ten individuals responded to my mass message and fifteen of the seventeen other contacts responded to my initial introduction by either referring me to someone else, stating that their department does not provide K-12 environmental education outreach, or setting up and interview. I completed eight in-person interviews. Of those eight, I have used information collected from six. Because the scope of this study changed during the interview process, two interviews were not suitable to include in this research. Interviews varied in length of time from approximately fifteen minutes to a little over an hour. Below lists current earth and environmental education programs and activities by Duke University and the Nicholas School of the Environment.

**BOOST Science Program** (Building Opportunities and Overtures in Science and Technology)
The BOOST Science Program provided by Duke University faculty and staff exposes minority and underrepresented populations of students in the Durham community to different sciences through field study and hands-on experiences. Students entering the fifth through eighth grade may participate in the various activities sponsored by BOOST. In order to reach students in these grades, BOOST offers classroom activities, summer workshops, and field trips (BOOST. Personal interview. 21. Sept. 2012.). Grade school students, teachers, and Duke University graduate school students all benefit from participating in the program. Teachers may further advance their professional development as well as learn new information for their classroom and graduate/professional students are able to not only give back to the Durham community directly through work with their student(s) but may also shape and shift the career goals of a young individual. Established eleven years ago, BOOST is the product of collaboration between Duke University faculty/staff and eight Durham public schools (BOOST. Personal interview. 21. Sept. 2012.).
**Environmental Science Summer Program (ESSP)**

Because William Chameides, dean of the Nicholas School, wanted to establish a program at the Nicholas School that would not only service as an opportunity for the Nicholas School to provide outreach but also a chance to introduce local students to Duke and The Nicholas School of the Environment, ESSP was developed (ESSP. Personal interview. 8. Oct. 2012.). As a recently developed environmental program to target high school seniors, the Nicholas School of the Environmental implemented the Environmental Science Summer Program in order to increase student awareness of environmental issues with water quality being the focus. Rising high school juniors and seniors participate in the 1-week summer program where they gain field experience, interact with faculty and staff from various disciplines, and get first hand professional development training from Nicholas School Career Center staff. While learning about water quality, students have the pleasure of interacting with staff from New Hope Creek (http://sites.nicholas.duke.edu/essp). Participants in the Environmental Science Summer Program also gain knowledge about the origin of their drinking water from employees of Durham utilities. In order to implement this program, the Nicholas School of the Environment collaborates with Durham Public Schools, the New Hope Creek Advisory Committee, and the City of Durham Department of Public Works.

**In class instruction**

As a requirement of students enrolled in the Nicholas School’s ENVIRON 590.40 Fundamentals of Environmental Education course, students must develop and implement a teaching module in a local Durham public school science classroom. Along with providing the class and teacher with this module, students also evaluate the effectiveness of environmental education instruction within their assigned classroom. Because the course functions as both a seminar and teaching practicum, enrollment in the course ensures that student-teachers gain sufficient knowledge about environmental education practice/approaches and its history (Course Synopsis).
Sarah P. Duke Gardens

Developed in 1934 within the inspiration of Dr. Frederic M. Hanes, an avid walker, Sarah P. Duke provided the funding for the establishment of the gardens (Sarah P Duke Gardens. Personal interview. 21.2.1013). The Sarah P Duke Gardens offer a number of environmental education programs for children of all ages. However, the majority of programing available is for students in pre-K- fifth grade students. Many of the gardens’ environmental education programs are developed by studying the science curriculum of the Durham Public School System and by creating activities that enhance and the information that students will receive in the classroom setting. In collaboration with Duke’s Nasher Museum, the Sarah P Duke Gardens have created a new program for second graders, Double Exposure: Connecting Science and Art at the Duke Gardens and the Nasher Museum. Double Exposure helps students to observe the connections between not only art and nature, but also math, science, and language art (Sarah P. Duke Gardens. Personal interview. 21.2.1013). In all of their programing, the Duke Gardens help youth learn about nature and the environment through inquiry, hands-on exploration, and observation. To make nature learning and outdoor activities a family event, the Sarah P Duke Gardens also offers family oriented activities. Students and adults learn about the environment together and about various outdoor activities that they can do at home. Over the years, the Sarah P Duke Gardens has increased its emphasis on education by making it a part of its mission (Sarah P Duke Gardens. Personal interview. 21.2.1013).

Special Events

How to Build a Forest is a theatrical installation performed at Duke University that illustrates the growth and destruction of a forest within eight hours (Vitiello, 2012). Created by Pearl Damour and Shawn Hall, How to build a forest begins as a bare stage and is slowly transformed into a bustling forest with the help of stage participants throughout the performance. Local K-12 classrooms visit the auditorium throughout the day to witness the forest’s transformation. In order to provide students with the opportunity to witness this great event, members at the Duke Environmental Leadership program in collaboration with the Coca-Cola Foundation helped to fund local K-12 classrooms (http://sites.duke.edu/howtobuildaforest).
Independent Instruction by students- Several Nicholas School students have volunteered or fulfilled the requests of different schools, teachers, and youth organizations by providing information and lectures about the earth and environmental sciences. Nicholas School students have provided formal or informal classroom lessons, help scouts gain nature badges, or assist in science fairs. Environmental topics vary and range from forestry conservation to sea level rise.

Table 1 Environmental Education Program Results

<table>
<thead>
<tr>
<th>Identity</th>
<th>Years</th>
<th>Approach</th>
<th>Philosophy</th>
<th>Target</th>
<th>Enrollment</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOOST</td>
<td>11</td>
<td>Research &amp; Place-based</td>
<td>Bio-Anthro</td>
<td>Rising 5th-8th</td>
<td>Voluntary</td>
<td>Varies</td>
</tr>
<tr>
<td>ESSP</td>
<td>1</td>
<td>Research &amp; Place-based</td>
<td>Anthro</td>
<td>Rising 11th &amp; 12th</td>
<td>Teacher Recommendation</td>
<td>Water Quality</td>
</tr>
<tr>
<td>Environ 590.40</td>
<td>2</td>
<td>Place-Based Service-learning</td>
<td>varies</td>
<td>K-12</td>
<td>Classroom Instruction</td>
<td>Varies</td>
</tr>
<tr>
<td>Sarah P Duke Gardens</td>
<td>Varies</td>
<td>Nature-Based</td>
<td>Bio</td>
<td>PreK-12 (Focus PreK-5th)</td>
<td>Voluntary/Field Trip</td>
<td>Varies</td>
</tr>
<tr>
<td>How to Build a Forest</td>
<td>1</td>
<td>Nature Based</td>
<td>Bio</td>
<td>K-12</td>
<td>Field Trip</td>
<td>Forests Growth and Importance</td>
</tr>
</tbody>
</table>

*Because there was variation amongst the individually led faculty and student instruction, I neglected to add it in the chart.*

Discussion

As illustrated in Table 1, earth and environmental outreach by Duke and the Nicholas School utilizes the various instructional approaches as mentioned earlier. K-12 environmental education at Duke seeks to illustrate what environmental science careers are like in practice through place-based instruction. The use of service-learning at Duke helps students to make the connection within their coursework and civic engagement. Nature-based activities provided by Duke introduce and help students articulate how much they personally value the
environment. Through research based instruct, Duke aids students through the process of inquiry-based exploration.

**Instructional approaches and philosophies within BOOST and ESSP**

Programs such as BOOST and ESSP provide students with both research-based activities and place-based activities. Participants in these two programs have the opportunity to meet and learn from individuals within the community whose daily occupations are to address environmental issues. Not only that, students who partake in both ESSP and BOOST get hands-on experience learning about the ecosystem through water sampling activities and animal dissections. BOOST, Building Opportunities and Overtures in Science and Technology focuses on encouraging underrepresented students who are currently interested in the sciences to continue to pursue this field as a possible higher education and career option. With environmental sciences being one of the fields of study within BOOST, students learn about different ecosystems (ecocentric and biocentric) and environmental issues, such as water quality, (anthropocentric) across the range of environmental philosophies.

Although they utilize some of the same instructional approaches, the underlying environmental philosophies of BOOST and ESSP are quite different. Where students participating in BOOST learn about various animals, ecosystems, and environmental issues across the philosophical environmental continuum, individuals enrolled in ESSP, Environmental Science Summer Program, focus on water quality as it pertains to human health and environments (anthropocentric). Although not greatly emphasized, ESSP does utilize some of the aspects within nature-based instruction by “sit-spots”. “Sit-spots” help students focus on nature and human interaction by allowing students to take a break from routine activities and focus their attention solely on their outside environment (Primitive Pursuits, 2011).

**Instructional approaches and philosophies within Environ 590.40**

Duke has taken the initiative to provide a course that not only meets the educational needs of students, but their civic engagement desires through service-learning (Environ 590.40 Fundamentals of Environmental Education). Individuals taking this Nicholas School course observe and present/teach in a local K-12 science classroom. Because students enrolled in the
Environ 590.40 course have the opportunity of developing and presenting a module within environmental education of their own choosing, the environmental ethics portrayed varies amongst the different individual student modules.

**Instructional approaches and philosophies within the Sarah P. Duke Gardens**

The Sarah P. Duke Gardens offer a number of different nature-based programs for preK-12 students. Programing at the Sarah P. Duke Gardens includes but is not limited to activities such as Changing Climates, Things with Wings, and the previously stated Double Exposure program (Sarah P. Duke Gardens Education and Events Guide). Activities and events sponsored by the gardens generally convey a message of biocentrism, focusing on the importance of various plants and animals (Yu and Yi, 2009).

**Instructional approaches and philosophies within Special Events**

The How to Build a Forest performance focuses on how intricate and delicate forests are by using seven and a half of the eight-hour performance to construct the forest and thirty minutes to break it down. Utilizing components from the nature-based approach, How to build a Forest also conveys messages within the philosophy of ecocentrism. Ecocentrism, similar to biocentrism, emphasizes the importance of all species, including humans and the interactions between the different species (Lindenmeyer and Burgman, 2005). In terms of individually led faculty and student instruction, approaches and environmental ethics/philosophies varied. Besides Duke University, there are several universities with departments devoted to the study of the environment, environmental issues, and environmental policy. In order to measure Duke and the Nicholas School’s outreach efforts, I evaluated the environmental outreach activities of Stanford University and Yale University. Both of these institutions have critically acclaimed environmental degree programs and make for good comparative subjects.

**Comparative University environmental science Outreach**

**Stanford University**

Designed as an independent department to offer programs and activities for faculty and students to fulfill their civic engagement requirements and research proposals, Stanford’s
Office of Science Outreach has dedicated its time and efforts to enriching the science knowledge of students in grades K-12 in the surrounding area. There are several programs and activities such as the Summer Research Program for Teachers, the Stanford Summer Teaching Institute, and field trips offered to elementary to high school teachers (http://oso.stanford.edu/programs). These programs seek to enhance the research skills of classroom teachers, provide teachers with different methodologies to teaching science, and display the latest in technological advances. Aside from multi-week programs, teachers as well as the public may attend many free lectures provided by Stanford faculty. Aside from the many programs focused on in-service (classroom) teachers, there are many more programs for the youth.

In order to provide research opportunities and training to high school students, several labs offer internships, usually unpaid, to students age 16 or older. RISE, Raising Interest in Science and Engineering, summer internship program allows high school students from low-income homes in the Bay area to gain research experience, a small stipend, and a graduate or postdoctoral mentor. Stanford also sponsors internship opportunities for high school students worldwide interested in studying medicine. Some summer programs at Stanford allow students to take classes and interact with other equally brilliant students in middle and high school. Stanford also developed the Geokids for first and second grades as a means to introduce children to geology. First and second graders learn about minerals, fossils, and what it means to be a geologist (http://oso.stanford.edu/programs). Aside from the programs discussed in this paper, Stanford also offers other educational opportunities in the earth and environmental sciences for K-12 students. Stanford students also offer science outreach.

Yale University

Similar to Stanford, Yale has a site that encompasses all of their science outreach. Most of the programs and activities listed on the site are to advance students’ knowledge of mathematics and the biological sciences. However, students may find some environmental science instruction by participating in Yale’s EVOLUTIONS program and the Girls’ Science Investigations (GIS) program (http://onhsa.yale.edu/science-programs-k-12-students).
EVOLUTIONS, an after school program for New Haven and West Haven high school students in the ninth and tenth grades, is sponsored by the Yale Peabody Museum of Natural History. EVOLUTIONS provides students with the opportunity to increase their scientific literacy and gain college prep training and information. Students work on annual projects and take field trips to science centers as well as different college campuses (http://peabody.yale.edu/education/evolutions/evolutions). As participants in GIS, Girls’ Science Investigations, young women in the New Haven area receive lectures by Yale students and professors as well as hands-on teaching instruction in the lab. Saturday, students learn information under a different subject matter theme. Past themes have included The Geophysical World and The Oceanographic World (http://gsi.sites.yale.edu/).

As a part of Yale’s School of Forestry and Environmental Studies outreach, is the Center for Green Chemistry and Green Engineering at Yale. The mission of the center is to forge a more sustainable future by green chemistry and engineering. Not only does the Center for Green Chemistry and Green Engineering service the Yale community, the center also provides outreach to the youth. One Individual at the center has embarked on a project to helped fifth grade students at the Greenwich Academy develop engineering designs with sustainability in mind (http://greenchemistry.yale.edu/education). By incorporating green chemistry and engineering into their work, students use their designs to help them construct an invention for Greenwich’s annual Invention Convention. Participants at the green chemistry and engineering center also present lectures to tenth graders in the New Haven community over the course of three weeks. Although these outreach activities introduce students to the idea of sustainable engineering and chemistry, they are lacking in environmental subject matter (http://greenchemistry.yale.edu/education).

**Recommendations**

After studying the environmental education outreach provided by Duke University, the Nicholas School, Stanford University and Yale University, I have developed four recommendations for Duke and the Nicholas School of the Environment that would be beneficial to teachers, students, and the university.
Teacher Training

While researching environmental education programs for K-12 youth by Duke and the Nicholas school, I saw very little evidence of aid and/or training made available for classroom teachers in the earth and environmental sciences. Besides the fact that I was only interesting in K-12 programing, I believe that because there is the NC Environmental Education Certification program, Duke University may not advertise their environmental science training for grade school teachers. Although the NC Environmental Education Certification program exists, Duke and the Nicholas School may still opt to provide additional training in the environmental sciences for teachers in partnership schools with the university. When studying what types of activities teachers find to be most valuable to their professional development, Sandholtz discovered that most teachers prefer co-teaching university courses and subject-specific conferences and/or summer projects (Sandholtz, 2002). Duke and the Nicholas School could fulfill their goals of influencing the community and forging a sustainable future by hosting courses, conferences and summer projects for local teachers. Not only do these activities provide K-12 teachers with opportunities to increase their professional development and to reevaluate their instructional approaches, attending school/university training courses allows teachers to interact with one another and exchange ideas (Sandholtz, 2002). By providing aid to teachers, Duke and the Nicholas School are indirectly affecting student of the Durham community. I believe that increased quality of environmental instruction in the classroom could affect how students view the environmental sciences as a field of interest. By providing aid for local teachers, Duke University illustrates its commitment to the Durham community and strengthens its reputation as a university that cares.

Student Internship Opportunities

Besides providing K-12 teachers with opportunities for training and professional development, Duke and the Nicholas School may also benefit by providing internship opportunities to interested students. In his study of business school programs with internship opportunities, Rick Weible saw that most universities felt that by offering internships, they had somehow become closer to the community (Weible, 2010). Not only did universities report a
greater sense of connection to the community, most universities (81.6% of 619) felt that students would most likely attend a university that offered internship opportunities for its students (Weible, 2010). There are also records in which participating students have documented the benefits they have observed in participating in university internships. One rising high school senior reported gaining knowledge and hands-on experience at their internship that helped them view their summer employment as a potential career path (Davis, 2010). Another benefit attributed to this student’s internship was the development of problem-solving skills (Davis, 2010). It is easy to observe why internship opportunities are important and how they are beneficial to both the institution and student. Not only would I suggest the university and Nicholas School to provide internship opportunities to older students in the K-12 age range, I believe there is a need for more environmentally based summer courses for students in grades K-12.

**Provide Summer Courses**

Most of the environmental science outreach done by Duke and the Nicholas school for students are summer programs that offer both academic and recreational activities. My suggestion here is that the university and Nicholas School provide outreach opportunities in which students focus on environmental science through a traditionally structured curriculum. These courses could serve as supplementary material to what students learn during the school year and provide a glimpse of what career options are available in the environmental field. Summer courses may allow students to explore an interesting subject more in depth than they would in the traditional classroom setting. Students are once again, introduced to faculty and staff at the university that may help them advance their educational careers and summer courses offer the university an opportunity to advertise itself to students. Depending on the structure of the coursework, students may receive credit towards their high and/or higher education requirements.

**Increase Use of Service-learning and Nature-based Instruction**

Within my research I have noticed that service-learning and nature-based instructional approaches to environmental education have been somewhat neglected by the university. My
final recommendation to the university and the Nicholas School would be to increase the use of the instructional approaches in current and future environmental education programing. As previously stated, service-learning forms a bond or linkage between classroom curriculum and civic engagement. Students that participate in service-learning activities generally have a greater connection and sense of citizenship within their community (Billing et al, 2000). Because Duke University has stated their commitment to the Durham community through the establishment of the Office of Durham and Regional Affairs as well as the Duke-Durham Neighborhood Partnership, it is important that the university as well as the Nicholas School provide opportunities positively influence the Durham community. Duke also illustrates this commitment by providing opportunities that allows local K-12 students to have an equally influential impact within the community. Besides increasing the use of service-learning activities, there is a need for more nature-based instruction within current, as well as future, environmental education programing.

Nature-based instruction is described as being the foundation to other forms of environmental instructional approaches. By introducing students to nature and natural materials, nature-based instruction allows students to freely observe and explore their natural environment. Research completed by Ballantyne and Packer about nature-based excursions showed that not only were primary and secondary students excited about out of class learning experiences, 41% of the 580 students felt that their view and opinion of the environment was impacted by their nature-based experienced (Ballantyne and Packer, 2002). When trying to create activities and opportunities for students to form impactful connections to the environment, Ballantyne and Packer thought it was best to allow students to explore the natural environment with little distractions from worksheets, and over structured guidance. The use of emotive interactions appear to aid students in considering their attitudes and actions that impact the environment (Ballantyne and Packer, 2002)

**Conclusion**

Although Duke University is a research-based university, several efforts have been made to increase students’ awareness of environmental issues and encourage students to pursue
interests in the environmental sciences. Throughout my research, I discovered five entities that present environmental information to students in grades K-12. Some of the programs or groups I have identified offer a number of environmentally based activities for students. The information I have compiled about Duke and the Nicholas School does not represent all of the possible environmental education outreach opportunities that may be available for Durham community K-12 students to participate.

In comparison to other research-based universities that offer environmental or earth science education to graduate and undergraduate students, Duke University appears to rank in the middle. Although there is room for improvement of Duke and the Nicholas School’s environmental science outreach, Duke University is providing more environmental education activities and opportunities to Durham students than what other universities have provided to their local K-12 students.

As time progresses and more resources are made available, I believe that Duke University and the Nicholas School of the Environment will be able to strengthen their influence on local students to pursue the environmental sciences by utilizing my recommendations. Training and professional development courses to teachers, more summer coursework for K-12 students, environmental internship for students, and the increased use and emphasis on service-learning and nature-based instruction will have a positive impact not only on how students view the environmental science, but positively impact the university as well.
References


Environ590.40 Course Synopsis https://www.siss.duke.edu/psp/CSPRD01_2/EMPLOYEE/HRMS/c/DU_SELFSERVICE.DU_SYNOPSIS_ENTRY.GBL?Page=DU_SYNOPSIS_VIEW&Action=U&CATALOG_NBR=%20590&CLASS_SECTION=40&SESSION_CODE=1&STRM=1420&SUBJECT=ENVIRON&TargetFrameName=None


Independent commission on Environmental education, 1997


Environmental Protection Agency Service-learning Learning by doing: Students take greening to the community Edition 3 http://www.epa.gov/osw/education/pdfs/svклеarn.pdf

National Park Services http://www.nps.gov/mabi/forteachers/upload/Benefits%20of%20PBE.pdf


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Appendix A

Interview Guide

Before interview
1) Greet the individual that I am interviewing and tell them a little about myself and the project
2) Hand them the informed consent form and briefly go over the key point
3) Be sure that the participants knows that they will be recorded

List of Sample questions ***In addition to these questions, be sure to ask follow-up questions to gain greater detail***

What types of interaction does your institution (university, department, program, or school) have with elementary or secondary schools as it pertains to environmental issues?

What is the mission your program seeks to fulfill as it develops and implements these programs?

How did this program(s) come to be?

What were any of the challenges your institution (university, department, program, or school) faced when planning, developing, and/or implementing your program(s)?

Why has your organization (university, department, program, or school) not been able to develop environmental education program for students in the 5-18 years old bracket?

In your opinion, what are the strengths and weaknesses of your program(s)?

How do you determine/evaluate the success of your programs?

Do you collaborate with any other higher education institutions to develop your programs?

At this time, I would like to ask if there is anyone, you would recommend or suggest for participation in this study. If yes, please that the same confidentiality measures that have been taken with your information will also be used for anyone you suggest.

Conclusion of interview
1) Be sure to ask the participant if they have anything they would like to express that they were not questioned about
2) Ask if they have any recommendation(s) of people to speak to
3) Thank them for their time and assure them if additional information is needed, you will be sure to contact them
4) THANK YOU EMAIL
Appendix B

Image 1Nvivo10 Nodes