

# Building a Sustainability Curriculum for the Sarah P. Duke Gardens

## ENVIRON 245 Project Brief

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### Group Members:

Will Graham

LJ Castellano

Jamie Kim

Matheus Dias

### Client:

Sarah P. Duke Gardens

Education Staff.

The Sarah P. Duke Gardens represent a unique educational opportunity for K-12 students to experience what they are taught in school. A field trip to the gardens provides a tangible and profound opportunity to augment the science and sustainability concepts K-12 students see in the classroom. The Duke Gardens educational programs wanted to expand upon the concepts of sustainability in their lesson plans. Promoting sustainability principles through the Duke Gardens positively impacts the Duke-Durham relationship. On a less tangible scale, the human race is entering a period where sustainability is crucial to the survival of our species, and indoctrinating children with an understanding of sustainability at an early age is a strong foundation for development.

Our main research question is how education staff at the Duke Gardens can best infuse concepts of sustainability in elementary school field trip programs. We have subdivided this research into three parts as the following.

1. What is the most effective way to integrate new sustainability principles in the pre-existing lesson plans?
2. What sustainability principles and concepts are highest priority to include in the training material for docents?
3. What aspects of sustainability will have the greatest tangible effects on students?

## Final Products for Client:

- 1) An effective training document for the duke Garden's education staff that gives a foundation for a general understanding of sustainability, and provides guidance to incorporate sustainability in specific lessons.
- 1) Create a promotional video to advertise volunteer opportunities to Duke undergrads.



Figure 1. Students observe fish and insects at the white Garden.

## Methods:

We used a study by Wiek, Withycombe, and Redman (2011) which outlined key competencies, and sub concepts crucial to understanding sustainability as a framework for our curriculum. Subsequently, we interviewed the leadership and student workers of the Garden education program to understand their goals and experiences. We recorded our interviews of two student education staff of the Duke Gardens and used that content to create our video. We then analyzed existing Garden's lesson plans and NC Science Standards to evaluate what level of complexity applies to which age group, as well as analyzing which lesson plans could be adapted to include sustainability.



Figure 2. Students experiment with soil and the concepts of erosions.

Interviewee	Role	Theme
Kati Henderson	Education Staff	Goals and Resources
Kavanah Anderson	Director of Edu.	Areas to improve
Sam Aldave	Volunteer	General thoughts. Promo video
Alyssa Cleveland	Volunteer	General thoughts. Promo video

Figure 3: Interviews Conducted by Research Team

The research included conducting shadowing of the tours with the local schools, and saw various lessons lessons being taught to elementary school children. The children reactions to the different material presented during the tours was observed on-site. During and after these lessons, the research team explored gaps in the curriculum and opportunities for integrating sustainability principles. On top of shadowing, the research team analyzed the written copies of every Duke Gardens lesson plan. The team coded for sustainability principles, opportunities to add sustainability principles, nature, intersection of nature and human activity, and other relevant themes. The team compared these lesson plans to Wiek et al. and the NC Standards of Science for each age group. This exercise informed our understanding of the range of complexity appropriate for the differing age groups. This allowed the research team to simplify concepts when necessary for suitable lessons. The team researched researched the overarching themes of the lesson plans to see how they intersected with sustainability, and sought to provide both an overall sustainability training for docents, and lesson by lesson examples. Finally, we synthesized data from a survey administered to teachers in the days after their tour by the Duke Gardens Staff. There were 47 responses to the survey, which was administered in 2013, discontinued, and then re-administered in 2018.

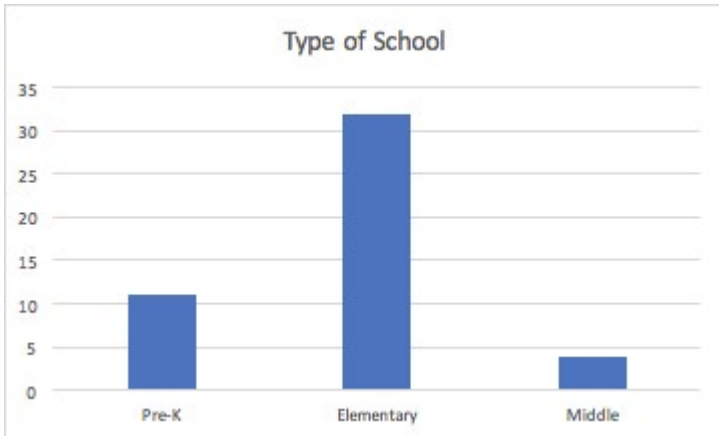


Figure 3: The respondents by type of school (n=47)

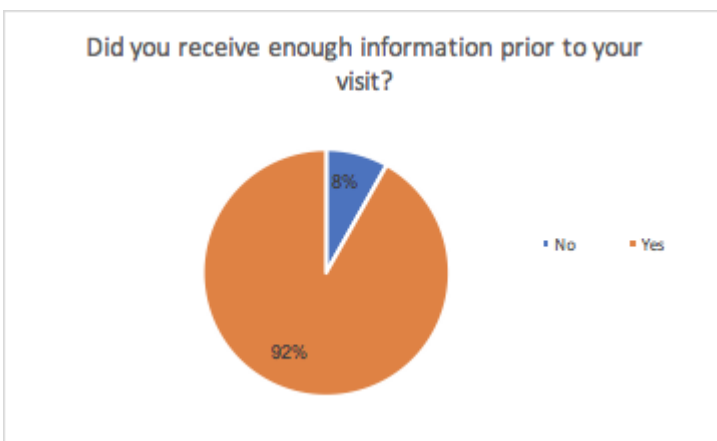


Figure 4: The level of preparedness from school teachers (n=47)

Figure 5. A student examines a sample captured in the Duke Gardens.

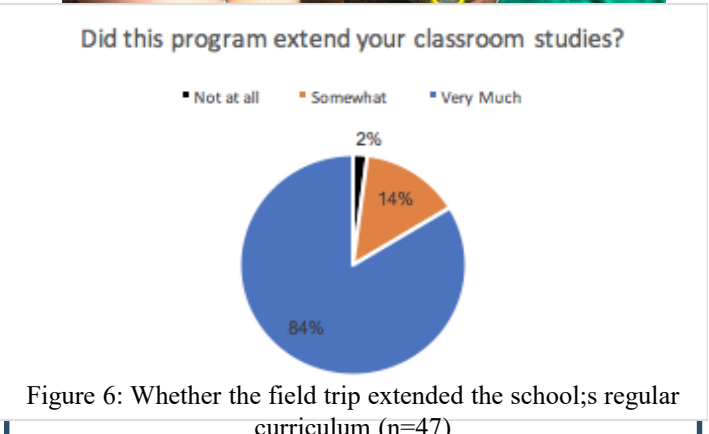


Figure 6: Whether the field trip extended the school's regular curriculum (n=47)

## Results:

Things to include in this section:

- Docents will benefit from a section that contains general training on the concepts of sustainability, included multiple definitions of sustainability, with emphasis on the Brundtland definition. The section also breaks down key terminology and outlines competencies like “normative competence” and “anticipatory competence.”
- Age groups Pre-K to 1<sup>st</sup> grade are likely too young to begin learning even the foundation of sustainability principles. Most are only beginning to learn to read, spell, and identify basic shapes and colors.
- Second and third graders are likely too young to be taught complete concepts of sustainability, but the foundations of understanding like human-nature interaction, cause and effect, and animal habitat can be used.

- Fourth and fifth graders can be exposed to general concepts of sustainability, including social, economic, and environmental impacts. Understanding of basic nature concepts, as well as the intersection of nature and humans have been taught, providing a foundation to discuss sustainability in simple terms.
- Students in middle and high school have the foundation necessary to understand the intersectional competencies of sustainability, including the dynamics of our economic systems and the environment. Therefore, their exposure to sustainability can be expanded by introducing ethical ideas, for example, why is it important to preserve nature?
- High school students can begin to analyze social systems and how they relate to sustainability by analyzing values, preferences, needs, perceptions, actions, decisions, power, politics, institutions
- The survey can be improved by adding additional questions involving tour-specific content, identifying if the students had already had a field trip to the gardens, and by reducing attrition through the use of calendar invitations and reminders.

## Conclusions:

### **The Gardens and Systems Thinking:**

The research team found that overall the Gardens are an excellent place to teach the concepts of sustainability. One of the founding ethos of the garden education program is for the students to understand their relationship with larger concepts like nature or society. Understanding ones relationship to larger systems is an integral part of sustainability education, and humans must understand the ripple effect of their decisions on the surrounding ecosystems.

### **The Docent Sustainability Training Manual**

The Docent Sustainability Training Document is divided into two parts. (1) The first is a general explanation on sustainability, which educates docents on the concepts of sustainability and also are teaching concepts consistently, regardless of the field trip. The general section contains sustainability themes we found most applicable to the Duke Gardens, including carbon sinks, climate change, and invasive species. (2) The second facet of the Docent Training Manual are lesson-specific sustainability teachings. We expand on lesson themes to more explicitly link them to sustainability. For example,

in the Discovery Gardens lesson plan which discusses the importance of honey bees to pollination, we recommended adding information on the invasive Varroa mite. This parasite was brought from Asia to North America by humans and is a large threat to honey bee populations, thus stressing both human and natural systems. Overall, The training document captures both general sustainability lessons and specific application.

Figure 7. The Duke Gardens Research Team!



### **Recommendations:**

- **Use the Docent Training Document as a background to educate volunteers, but continue research on how the Gardens are an example of sustainability and use sustainable practices.**
- **Create a *Sustainability in the Gardens* lesson plan for future students, using the materials and information provided by the research team.**
- **Improve the post-field trip teacher survey to include specific questions on the lesson administered.**

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