Beyond the Beakers

University of North Carolina at Pembroke
Esther G. Maynor Honors College
Senior Service Project by: Anna Queen
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Beyond The Beakers

By: Anna E. Queen
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Abstract

BEYOND THE BEAKERS

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Honors College Senior Project
Esther G. Maynor Honors College
University of North Carolina at Pembroke
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This project is designed to fulfill my senior project graduation requirement for the Esther G. Maynor Honors College at the University of North Carolina at Pembroke. This service opportunity consisted of teaching fifth grade science for two days at Washington Park Elementary School in Laurinburg, NC. The steps involved are as follows: planning lectures, creating power point presentations, checking out books from the library, online and text literature research, selecting and gathering materials for experiments, practicing experiments and presentations, evaluating my time at the school, and writing a written component detailing my activities surrounding the project. The topic involved was the weather, and experiments were based on (a) clouds and pollution, and (b) thunder and lightening storms. The service opportunity was extremely successful. I was able to teach the students, and I learned many things from them as well. Future connections have been made at Washington Park Elementary, opening the door for future Honors College students to provide community service there.

Introduction

I am a student at the University of North Carolina at Pembroke. I have a double major: biology with a biomedical emphasis and chemistry for pre-health professions, and a minor in Spanish. My career goal is to obtain an MD/PhD degree and devote my life to HIV/AIDS research. I am a member of the Esther G. Maynor Honors College here at the University of North Carolina at Pembroke. There are two honors track one can pick from: university track (which consists of a senior project), or departmental track (which consists of a senior thesis). I chose to do both university and departmental tracks. This senior project will fulfill my graduation requirement for the university track. According to the Esther G. Maynor Honors College Senior Project Handbook, the senior project is listed as "A culmination of your work in the major. The topic should not be trivial and you should believe that your project is important and worthwhile." There were four options to choose from for a project (community service, campus dialogue, creative project, or a senior thesis project), and I picked to do a service project. I like working with people and I like to help the community.

When deciding on what to do for my project, I spoke with my mentor Dr. Bonds-Raacke. I decided to do something within my majors (biology and chemistry). Dr. Bonds-Raacke suggested that I do some experiments for elementary school children. I picked the 5^{th} grade because these children are not too young for the semi-complicated

concepts, but not too old for the fun experiments. She connected me via email with Mrs. Gail Cassidy, the 5th grade science teacher at Washington Park Elementary School in Laurinburg, NC.

Planning the Project

My first step was to pick out some experiments I wanted to do. I did some research and found three experiments that deemed fit for the 5th grade skill level: gravity, sound and noise, and density. My next step was to meet with Mrs. Cassidy. I went one day during her planning period and talked with her about exactly what I had in mind. She informed me that there were three different 5th grade science classes: high group, medium group, and "at risk" group. The high group consisted of the 5th graders that had the highest test scores when they came from the 4th grade. The medium group was the "average" group. The "at risk" group consists of the lowest testing children in the school. (They are labeled "at risk" instead of "low" in order to keep the students from feeling inferior.) Each group meets with her for an hour and a half each day. She then spoke with me about how to talk to the students. This included how to: (a) ask stimulating questions, (b) pay attention to the special needs, (c) be a friend but also an instructor, and (d) be prepared for any question or circumstance. She then informed me that the 5th grade science fall curriculum was about the weather. Each week was a different weather related topic, so my experiments needed to coincide with the topic they were discussing. At this

meeting with Mrs. Cassidy, she also provided me a copy of the North Carolina/Bloom Standards, which was a booklet titled "Asking All The Right Questions." This booklet was a guide for including North Carolina thinking skills in a classroom setting and involved various levels of thinking and reasoning.

Table 1. **"Asking All The Right Questions" North Carolina/Bloom Standards:**

Knowing	**Organizing**	**Applying**	**Analyzing**	**Generating**	**Integrating**	**Evaluating**
Useful verbs: List Name Label Recall Identify Match Choose	**Useful verbs:** Categorize Group Classify Compare Contrast	**Useful verbs:** Apply Make Show Record Construct Demonstrate Illustrate	**Useful verbs:** Outline Diagram Differentiate Analyze	**Useful verbs:** Conclude Predict Explain Elaborate Infer	**Useful verbs:** Combine Summarize Design Imagine Generalize	**Useful verbs:** Judge Evaluate Rate Verify Access Define criteria
Sample question stems: -When was…? -Who did it? -Define the word _____. -What is a _____? -Label the following: -Identify the _____ in the _____. -Who is the narrator of the story?	**Sample question stems:** -What conclusion have you reached about _____? -Explain the main idea and illustrate it. -What do the characters have in common? -What traits best describe the hero in the story? -In your own words,	**Sample question stems:** -What is _____? -What evidence is there that _____? -In way might _____? - Give some instances in which ___? -Which of these words ..? -How would you use this information to start a program yourself? -Write what	**Sample question stems:** -Make believe? -What would be a good title for…? -What are the functions of …? -Categorize the _____ of _____? -Sort the _____. -What is the order of the steps in __? -Compare _____ to _____. How are they	**Sample question stems:** -If you had been… what would you have done differently? -How many ways can you think of to …? -What would happen if _____? -Predict what would be true if ____? -How can you explain…? -	**Sample question stems:** -How many ways can you think of …? -Conclude what the result would be if… -Summarize the story in your own words. -Devise a plan to…	**Sample question stems:** -What would you do? -Judge what would be the best way… -Evaluate whether you would… -Should _____ be permitted to..? Why or why not? -Is _____ accurate? Yes or no? -Why do you think…? -Was it right or wrong for …? Explain. -How well

	tell _____. -How else might you say _____? -What is the purpose of _____? -Which picture shows _____? -Describe. Show how… Compare… -Tell what you think… -Is _____ greater than ____? -Why is it called ___? -Explain why _____ caused _____?	you have learned and how you can use this information in your life?	alike? Different? -Now that we have studied this, what can be concluded about _____?	Hypothesize what would happen if…		did…? -What is the most important? Why? -Which of the following…? -How effective was…? -What could have been different? -Based on your previous answer, do you think you could have… Tell how.

The book involved the seven steps outlined above: knowing, organizing, applying, analyzing, generating, integrating, and evaluating. Each step included useful verbs and sample question stems to use when teaching. Take for example, integrating. The verbs were: imagine, combine, summarize, and generalize. The sample question stems were: "How many ways can you think of…?" and "Devise a plan to…" I had to read and study this booklet in order to ask the children questions that could pick their brains and inspire them to think deeper.

The next step I took was planning my experiments. I had already picked out the experiments I wanted to perform for the children (gravity, sound and noise, and density), but after speaking with Mrs. Cassidy, I had to tailor my experiments to their assigned weather topic according to the week I was there.

Day 1

The experiment for day one needed to be about clouds. I needed something safe and easy to do and understand. The experiment I chose was making a cloud in a two liter bottle using warm water and a match. I complimented this experiment by showing a video about clouds, reading a book about clouds, presenting a power point presentation about the various types of clouds as well as how they are formed, and lastly a power point presentation about pollution and the harmful effects.

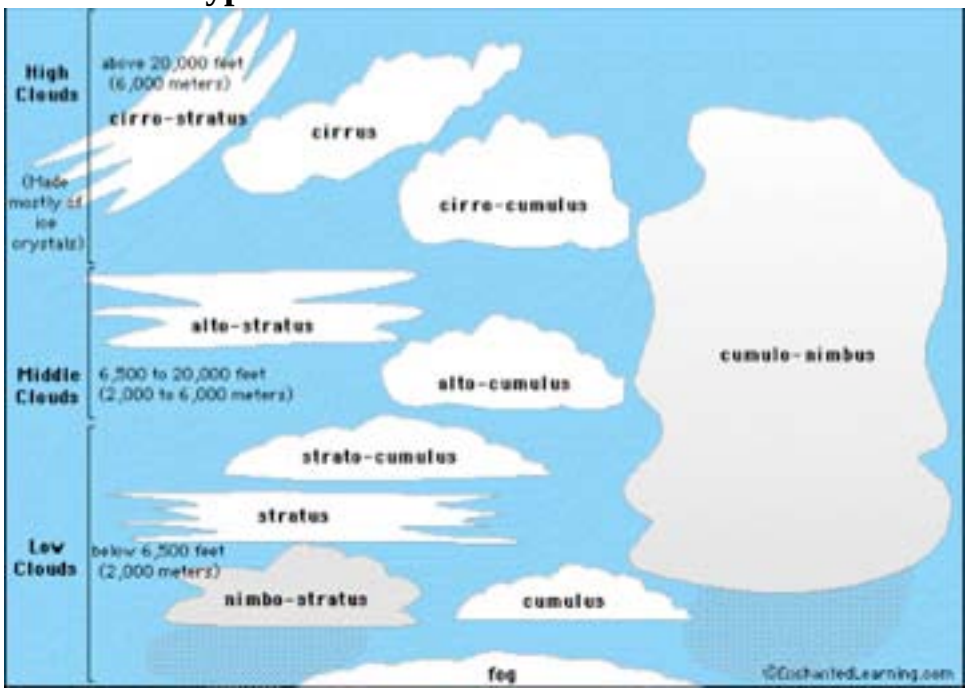
Table 2. **Outline for Day 1**

Lecture	20 minutes
Book about clouds	15 minutes
Video about clouds	5 minutes
Power point about clouds	5 minutes
Power point about pollution	15 minutes
Experiment	5 minutes
Discussion	15 minutes

Total time: 1 hour 20 minutes

During my lecture, we first discussed clouds. Clouds are formed when water vapor is cooled enough to form tiny water droplets. This is exactly what happens when moist air rises in the atmosphere, cools, and water droplets form into clouds. The children already knew about how clouds were formed, so I asked many questions and they were excited to answer them. I used the "knowing" and "analyzing" sections of the North Carolina/Bloom Standards booklet, and asked questions such as "How can define the word cloud?" and "What is the order of the steps in cloud formation?" I had them tell me all the information they knew about clouds. We talked about the different types of clouds, such as cumulus, fog, nimbus, stratus, and cirrus. I used the "knowing" section of the North Carolina/Bloom Standards booklet again and showed them this picture blank and had them fill in which cloud was which type:

Figure 1. **Cloud Types**



Then we discussed pollution. We discussed the sources of pollution, how it impacts the environment, the human race, and animal/plant species. We discussed briefly the regulations and rules placed on factories and plants about the emissions they can put into the air. We then discussed what effects these emissions have on clouds and what causes acid rain.

The power point I showed consisted of pictures of :

← Figure 2. **Pollution from factories**

Figure 3. **Waste pollution →**

← Figure 4. **Gas and oil pollution**

Figure 5. **How pollution → effects the lives of humans**

← Figure 6. **How pollution effects animals and habitats**

Lastly, we talked about what each person can do in order to help the environment, i.e. "going green." I discussed how each person might think throwing a McDonalds bag out of the window of their car cannot hurt the Earth because it is such a small thing. But if everyone in the school threw a McDonalds bag onto the playground, the playground would become junky. My example that made the students laugh the most was about Mrs. Cassidy. I lined everyone up and put Mrs. Cassidy at the very end of the line. I told them all to pretend that they lived along the same stream, and they all threw their garbage into the stream. The person most upstream would not see any pollution or effects on the water. However, by the time the water got all the way down to Mrs. Cassidy's house after

everyone had thrown their garbage in it, the water would be dirty and polluted! I reminded the children that all rivers lead to lakes which eventually lead to the ocean. Their garbage would not only be seen by Mrs. Cassidy, but could also effect the whales and fish in the ocean. The children understood this example very well and thought it was hilarious that Mrs. Cassidy could hypothetically end up with all of their trash.

Experiment 1

I asked the children to repeat to me how clouds are made and formed. After this quick review, I preceded to perform the clouds in a bottle experiment. The experiment is outlined as follows:

Figure 7. **Cloud Experiment**

Experimental procedure:

Materials

-1-liter clear plastic bottle with cap

-Water

-Matches

Experiment

1. Place just enough warm water in the bottle to cover the bottom.

2. The goal of this next step is to get some smoke particles into the bottle. Light a match and let it burn for a few seconds. Blow the match out and immediately place the head of the match in the bottle. Let the smoke from the match fill the bottle. After a few seconds, the smoke will seem to disappear, but the invisible particles are still floating around in the bottle. All of this happens fairly quickly.

3. Screw the cap on the bottle being careful not to let too much smoke out of the bottle.

4. Squeeze the sides of the bottle really hard 6 or 7 times (more squeezing may be necessary). Squeeze the bottle again, hold the squeeze for a few seconds and then quickly release the squeeze. The second you release the squeeze, you should see the formation of a little fog in the bottle. This is the cloud!

How does it work?

Even though they are not seen, water molecules are in the air all around us it is called water vapor. When the molecules are bouncing around in the atmosphere, they don't normally stick together. Squeezing the sides of the bottle forces the molecules to

squeeze together or compress. Releasing the pressure allows the air to expand, and in doing so, the temperature of the air becomes cooler. This cooling process allows the molecules to stick together more easily forming tiny droplets and clouds are nothing more than tiny water droplets!

The smoke in the bottle also helps this process. Water particles will group together more easily if there are some solid particles in the air to act as a nucleus. The invisible particles serve as the nucleus and help in the formation of the cloud. Clouds on Earth form when warm air rises and its pressure is reduced. The air expands and cools, and clouds form as the temperature drops below the dew point. The invisible particles in the air may be in the form of pollution, smoke, dust or even tiny particles of dirt.

Additional Information

Sources for this information included the Exploratorium website and the National Hands-on Science Institute.

The experiment was successful, however it was not very exciting and hard to see. The children did not ask many questions about the experiment. By the time I had walked the two liter bottle around the room for everyone to see, the cloud had dissipated. My theory is that the “cloud” seen on the inside of the bottle was not an actual cloud forming, rather the smoke from the matches.

Day 2

For day 2, I needed an experiment related to thunder and lightening. This experiment needed to be easy to understand, safe, and more interesting that the cloud in a bottle. I thought very hard about this experiment and found many things to do, such as creating lightening using a pie pan and a pencil. However, this did not seem very safe to me as this class was very hands-on. I finally remembered this synthetic device that was used in my physics 1 class. I went to Dr. Bill Brandon and he said I could borrow it. The students thought it was the coolest thing! It basically generated an electric current shooting from one metal ball to another (i.e., a streak of lightening). I complemented this experiment with books about hurricanes and tornados, a video of a tornado, and a talk about tropical storms, hurricanes, tornados, and lightening and thunder storms.

Table 3. **Outline for Day 2**

Lecture	15 minutes
Book about hurricanes and tornados	10 minutes
Video about tornados	5 minutes
Talk about storms types	20 minutes
Experiment	10 minutes
Discussion	20 minutes

Total time: 1 hour 20 minutes

The lecture first started off with a talk about different types of storms. The children had many bright ideas such as "typhoons, cyclones, and blizzards." We talked

about how hurricanes and tropical storms are formed, as well as tornados. We discussed in depth lightening and thunder storms, and what causes lightening and thunder. The experiment went very well and I did it several times. This also generated some very interesting questions from the kids such as "why don't air planes get struck by lightening?" and "how do you name a hurricane?"

Experiment 2

Figure 8. **Synthetic Lightening Experiment**

Experimental Procedure:

Material

-Synthetic electric charge lightening device

Experiment

1. Arrange the two metal balls about two inches from each other

2. Turn the wheel on the synthetic device slowly at first, then vigorously until a lightening bolt is shot from one charged metal ball to the other.

How does it work?

When the wheel begins to turn, you pull electrons off one metal ball and pile them up on the other. Some of the electrons in metals are free electrons --they can move around inside the metal. These free electrons try to move as far away from the other metal ball as they can. When enough electrons have piled up on one ball and there is a deficiency on the other metal ball, the free electrons will jump from one ball to the other, creating a lightening bolt due to the discharge of electrons. After the electrons jump to the other ball, the balls have an imbalance of electrons (one ball has more than the other). If you hold your finger close to the metal, electrons jump from your finger back to the ball, making another spark. When you push the two balls back together, the whole process starts over again. This experiment is a mini-scale example of how lightening actually occurs. You see lightning when a spark of moving electrons races up or down between a cloud and the ground (or between two clouds). The moving electrons bump into air molecules along the way, heating them to a temperature five times hotter than the surface of the sun. This hot air expands as a supersonic shock wave, which you hear as thunder.

Additional Information

Sources for this information included information from the Exploratorium and the Weather Eye Website.

Evaluation of Classes

My time at Washington Park consisted of two days where I saw each level of class for an hour and a half each day. I taught for four and a half hours each time I was there.

← Figure 9.
High Group

The high level group was very intelligent. Almost everyone was involved and raising their hands to ask questions. One little girl in the corner completely stole my thunder and mentioned that the specific cause of lightening was a "discharge of electrons," which I did not expect any fifth grader to know! I did not know that as a fifth grader. She informed me that she wanted to be a scientist when she grew up. Some of the things I was asked made me stop and think "Wow! I do not know the answer to that!" I had to refer to Mrs. Cassidy's help on more than one occasion, but she did not know all the answers either. I prompted the students to go home and do some research on these things that they had questions about.

← Figure 10.
Medium Group

The medium level was about the same as the high level, just with less participation. The students knew about the same information and asked the same questions, but not everyone was involved. They really liked the hands-on activities, as well as the power points presentations. One boy in this class actually had an experiment that he did as well involving a balloon, baking soda, water, and an empty soda bottle. I must say, his experiment was more interesting than my cloud in a bottle. Mrs. Cassidy asked me to provide some insight about his experiment to the class, regarding what chemical changes and properties were causing the balloon to inflate. I was a little stumped because I do not know much about baking soda and water reactions, but I was able to do some research on it between days one and two; I provided the class with the information I had found out when I returned to teach the second day.

← Figure 11.
"At risk" group

The "at risk" group was not very involved. I had to ask many questions and keep addressing the children who were goofing off and not paying attention. One boy kept telling me he liked my shoes and that I was "cute" as opposed to answering my questions. However when I got to the experiment of using the synthetic device to create lightening, they were very interested and asked many questions. They asked to see it again and again.

Personal Gain

I enjoyed working with each and every group, but my favorite was the medium level because they had some idea of what I was talking about, but they did not know too

much as to not be interested in what I was trying to teach. When evaluating the success of my time with the fifth graders, I first thought of the first day I was there. The cloud experiment was not overly interesting, I needed something more to hold their interest. Mrs. Cassidy also gave me some advice, that by the time I got to the last group I had left a few things out of my presentation because I was tired of talking for four and a half hours and weary! She reminded me that it is important that everyone hears the same information. I took this very seriously and on day two, I finished strong with everyone on the edges of their seats! I had managed to pick a "cooler" experiment, and everyone was excited and asking many questions.

I learned how to relate to the students on their own level. For example, on day one when I was discussing the pollution, I mentioned something I had seen on the Disney Channel, the "Disney's Friends For Change." Basically this was the Disney Channel stars promoting eco-friendly living: turning off the water when brushing your teeth, turning off the lights when you leave the room, and taking shorter showers. Most of the children had seen this so they knew exactly what I was talking about. This proved to be easier for them to understand than my discussing rules and regulations of gas companies and factories with them.

Through teaching them, I learned many things myself. I needed to think back to when I was in the fifth grade and remind myself to be on "their" level. I was not near as old as their regular teachers but not as young as the students, so I worked to find a

balance between the two so I could be a friend and an instructor. Also, if they thought a young person was interested in science, they would think it was cool as opposed to the typical fifth grade label of "nerd." By finding this balance, I was also able to make future connections to come back to the school. Mrs. Cassidy invited me back at any time. I am also on the Chemistry and Physics Club Demo Team at UNC Pembroke, and we are going to do a demonstration at Washington Park Elementary in the spring of 2010. The fact that my teaching went well has opened up many opportunities to bring science into this school. I also got several hugs when I left, and invited to a birthday party. This was proof for me that I was not just another lecturer to these kids, but they felt like I was approachable.

Personally, I feel I gained many things from this service project. First off, I had to refresh my mind about the weather! It had been years since I thought about what causes different types of weather. I prepared for this by doing research online and reading some books about the weather. When I got to Washington Park on my very first day, the class performed the "Weather Cycle Boogie" for me. This song basically consists of the words "The weather cycle boogie goes up and down. The weather cycle boogie goes all around. Evaporation! Condensation! Precipitation! Infiltration, percolation, ground water! Transpiration!" These words in themselves were a wake up call for me, because I did not

remember what half of them meant, nor could I recall learning some of them. So after day one of being at Washington Park, I went home and looked up what those words meant.

The fifth grade students referred to me as "the scientist." While this made me feel good, it also opened my eyes to something very valuable. These children, much like all the children sitting in all the other classrooms across America, are our future. It was my job to spark their interest in science. Getting them to ask questions is the key. For example, I was asked questions like "Why don't we get burnt when we hold a handle of a hot frying pan?" and "How does recycling actually work?" If one becomes interested at an early age, they are more likely to keep finding out more and more information. And if they ask the questions they really want to know the answers to, they will work until they find an answer.

Recommendations for Future Students

For future Esther G. Maynor Honors College students planning on doing a service opportunity for their senior service project, I have some advice. Make sure you pick something you like! It does not necessarily need to be something related to your major, but if you like helping people, a service opportunity is a perfect experience! You need to make sure it fits within your schedule. I am a very busy person, so if you pick something

time consuming, make sure you can make the time commitment. My project took up about six hours each day I went including travel time. I also spent many hours preparing my experiments and doing background research on the topics covered. Lastly, if someone offers some constructive criticism, take it to heart! The people in charge have been through the ropes and will do everything they can to help you improve your skills and better relate to the people you will be coming in contact with during your service opportunity.

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