

# W. J. Keenan High School



## AdvancED STEM Indicator

6.2: The interdisciplinary problem-based curriculum focuses on deeper learning with real world applications.

## **6.2: The interdisciplinary problem-based curriculum focuses on deeper learning with real world applications**

- Solar Grant award letter, alignment of project with Project REAL, school, and district mission statements, and solar applications to Freshman Academy core content and PLTW classes.
- English III Job Shadowing Project (school-wide requirement)
- English IV Senior Project (school-wide; interdisciplinary)
- Final report for Genes and Genealogy project (and African-American Studies integration of mtDNA into curriculum)
- DNA barcoding project summary
- Student work sample: Website design (CATE)
- Student work sample: Business plan (CATE)



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**PaCE AWARDS THREE SOUTH CAROLINA EDUCATIONAL INSTITUTIONS WITH SOLAR GRANTS**  
*Organizations Will Use Grants to Reap Benefits of Solar Technology*

**COLUMBIA, S.C. (Oct. 3, 2014)** – Three South Carolina educational institutions, including a zoo, will soon begin generating electricity using solar panels as a result of financial assistance provided by Palmetto Clean Energy (PaCE), a South Carolina nonprofit that promotes renewable energy resources.

PaCE's Solar Matching Grant Program – first introduced in 2013 – targets K-12 schools in South Carolina, and this year also considered other education-focused nonprofits, such as museums, science and nature centers, zoos and aquaria. Institutions may use grants to cover 50 percent of a solar installation or up to \$50,000 per installation.

The program is aimed at enabling more schools and other nonprofit educational institutions to take advantage of solar technologies by assisting with upfront costs involved with installation.

The three applicants selected for funding in 2014 are:

- Riverbanks Zoo and Garden (Columbia)
- Keenan High School (Richland County School District One)
- Lower Richland High School (Richland County School District One)

“We are pleased to announce the latest recipients of PaCE's Solar Matching Grant Program especially during National Energy Action Month when there is a focus on renewable energy sources,” said Bob Long, chairman of the PaCE board of directors. “By reducing initial installation costs these grants allow educational institutions to harness the power of solar energy. In addition, the visibility of the solar arrays will contribute to educating students and the visiting public about how sunlight can be transformed into renewable energy that is part of our sustainable energy future.”

In 2013, five applicants were selected for funding in the first round of the Solar Matching Grant Program:

- Bluffton High School (Beaufort County School District)
- Dixie Plantation Educational Holdings LLC, Environmental Research Stations at Dixie Plantation (College of Charleston)
- Griggs Road Elementary School (Clover School District)
- Roper Mountain Science Center (Greenville County School District)
- Whale Branch Early College High School (Beaufort County School District)

Installation work is ongoing at the schools and is expected to be completed later this month.

The program is funded by a previously announced contribution by Duke Energy.



**About PaCE**

Palmetto Clean Energy is a nonprofit renewable energy organization designed to encourage the development of renewable energy resources that improve the environment through reduced greenhouse-gas emissions. PaCE is a collaborative effort among Duke Energy Carolinas, Duke Energy Progress and South Carolina Electric & Gas, working with the South Carolina Energy Office and the South Carolina Office of Regulatory Staff to provide more than 1.2 million South Carolina customers with an opportunity to support green energy initiatives through tax- deductible contributions. These contributions are collected by the utilities and distributed to PaCE in their entirety. For more information or to make a contribution to PaCE, visit [www.palmettocleanenergy.org](http://www.palmettocleanenergy.org).

###

*Please describe how the installation of solar at your institution aligns with your mission.*

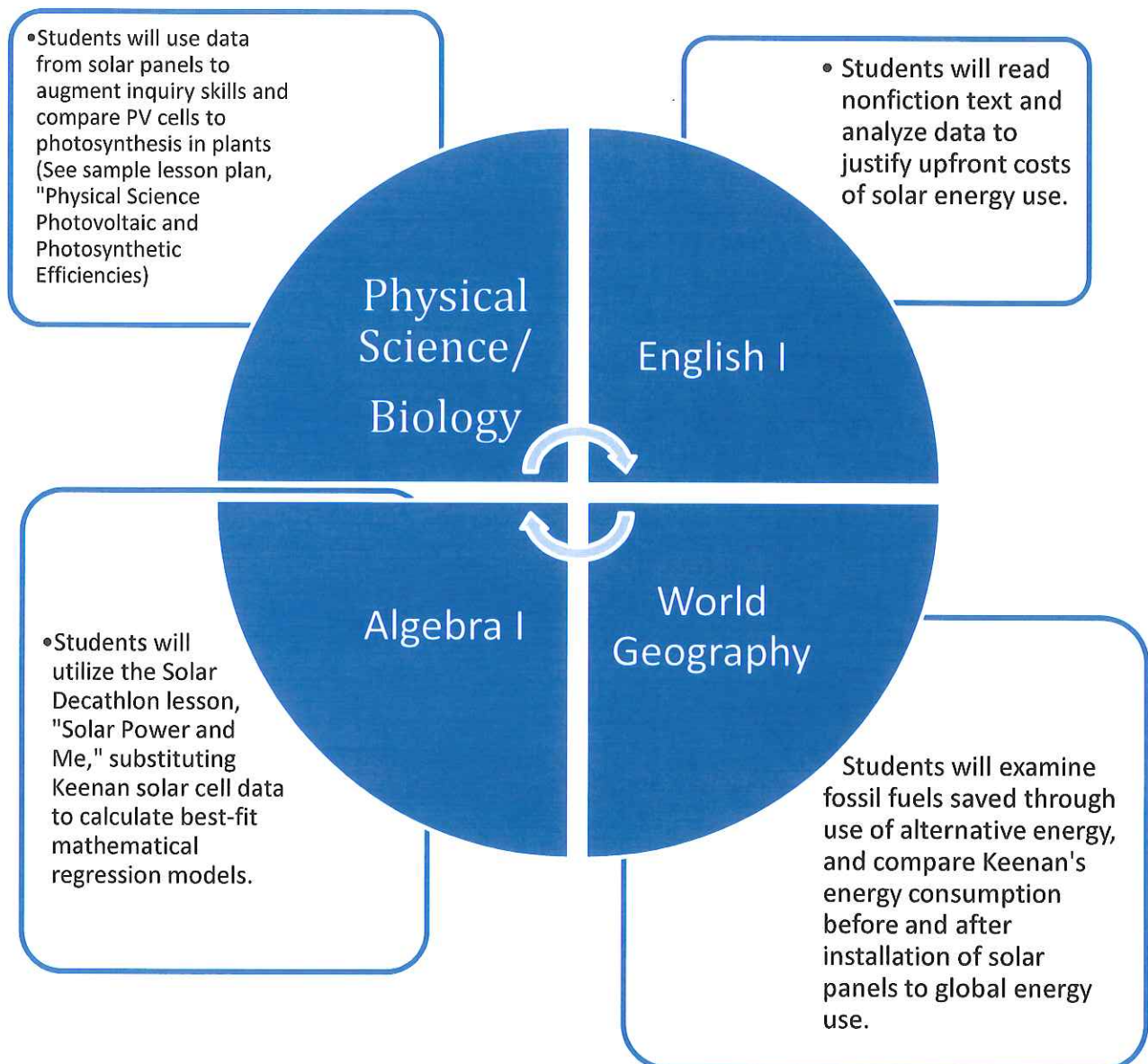
Installing a solar panel at W.J. Keenan High School would directly align with the missions of its engineering program (Project REAL), the school, and Richland School District One. The mission of the W.J. Keenan High School Raider Engineering and Academic Leadership Program (Project REAL) is to create a K-16 pipeline of scientific and technically literate leaders for the twenty-first century. Project REAL students are required to take at least four of six college-level engineering courses, all of which utilize project-based learning in their pedagogies. The integration of solar energy into this program would provide students with an onsite, real-world opportunity to apply lessons learned from each course to the installation and operation of the solar PV project. For instance, freshmen Introduction to Engineering Design students would be able to follow the timeline of installation and compare it to their studies of the design process. The next year, the same students could use the real-time data in their Digital Electronics course to make their studies of Ohm's law and electric resistors relevant. By their junior year, students could apply their understanding of solar energy to optimize photosynthesis in plants in biotechnical engineering, or design a more efficient model in Principles of Engineering. Moreover, an onsite photovoltaic cell would supplement Project REAL's focus on environmentally sustainable engineering practices, and serve as an "umbrella project" to tie together all course studies. While other projects could also fulfill this educational niche, solar energy would be preferable, as the demand for engineers and engineering technicians familiar with photovoltaic cells will only increase as fossil fuel availability wanes. For these reasons, providing an onsite solar panel could augment the mission of Project REAL to provide technically literate leaders for the twenty-first century.

The mission of W. J. Keenan High School is to provide an environment conducive to learning, which will enable each student to become a productive and self-reliant citizen in a global society, through diverse and challenging academic experiences in cooperation with the family and community. Solar panels onsite would contribute to the school's commitment to "go green" as part of its preparation of all students to become global productive citizens. In the past few years, Keenan has made a conscious effort to increase environmentally friendly practices, such as implementing an agriculture curriculum, offering AP Environmental Science, and initiating school-wide recycling and energy conservation initiatives. The presence of solar photovoltaic cells on the Keenan campus would emphasize the school's commitment to increasing environmental awareness within the school and community.

Richland School District One's mission states, "We are Richland One, a leader in transforming lives through education, empowering all students to achieve their potential and dreams." Within this mission, the district has three objectives, one of which states that "Students will demonstrate higher order thinking, social skills, and character traits necessary to be contributing citizens in a global society." As part of preparing students to contribute to a global society, it is imperative that they have concrete experiences with energy sources that will be available in their futures. In this way, the installation and use of photovoltaic cells would fulfill this objective, by increasing access to studying solar energy at the high school level, as well as potentially reaching younger grades through service learning projects with feeder elementary and middle school students.

*Please describe your plans to incorporate student and/or community outreach and education into the installation and operation of the solar PV project.*

The solar PV project would initially be integrated into all Project REAL courses and the Freshman Academy as an interdisciplinary project across the core curricula. Once these programs have been established, the photovoltaic cells would be used as a service learning opportunity for the Project REAL students and Teacher Cadets to education elementary and middle school students in the practical application of solar energy. To begin with, solar energy efficiency can be studied in each of the four core curricula taught in the Freshman Academy, as seen in the following diagram (number of students participating will be over 200):



The following is an overview of the applications of the installation and operation of the photovoltaic cells in each of the six engineering courses (Anticipated number of students is 75 or more):



*Please describe your institution's Post-Installation Solar Evaluation Plan, to include how you will evaluate the effectiveness of the project, track fossil fuel saved and greenhouse gas emissions avoided.*

## **1. Evaluation of Educational Outcomes**

**A. Freshman Academy Interdisciplinary Project: As the purpose of this project is to increase student achievement and interest in solar energy, success of the solar project will be measured by the following indicators:**

- Number of students participating in solar energy interdisciplinary project
- Percent increase in End-of-Course exam passage rates for Algebra I, Biology I, and English I.
- Percent increase in student interest and relevance of alternative energies from pre-project to post-project KAP (Knowledge, Attitudes, and Perceptions) surveys

**B. Project REAL Integration of Solar Energy**

- Percent increase in end-of course exam passage rates (as defined by Project Lead the Way) from pre-implementation of project to post-implementation
- Percent increase in student interest and relevance of alternative energies from pre-project to post-project KAP (Knowledge, Attitudes, and Perceptions) surveys
- Percent increase in "completers"- students completing four or more engineering courses from pre-implementation to post-implementation.
- Percent increase in student enrollment in Project REAL from pre-implementation to post-implementation of solar energy.

**C. Service Learning/Outreach**

- Number of K-8<sup>th</sup> grade students participating in a solar energy outreach activity conducted by Project REAL and/or Teacher Cadets
- Percent of teachers from service learning activities who agree or strongly agree that the outreach experience increased their students' interest in STEM (as measured by post-activity survey).



## JOB SHADOWING PROJECT

“**Job Shadowing**” is considered to be any project where the student spends an extended amount of time with someone in the work force to either observe and/or to help perform daily tasks associated with the occupation.

**\*\*Each student enrolled in English III CP at Keenan High School is required to complete this project.\*\***

Below are the **REQUIREMENTS** for the Job Shadowing Project:

- The minimum length of the job shadowing experience is eight (8) hours. These hours can be completed in a “live” setting or via the virtual shadowing experience. When shadowing:
  1. Take a digital camera, interview questions, notebook, mentor evaluation form, and lunch money with you on the shadow. Ask for permission to take digital images.
  2. Dress professionally or appropriately for the job shadowing location.
  3. Be courteous. Use a firm handshake when greeting the person you will shadow. Thank the person and again use a firm handshake when leaving.
  4. Take notes, collect company materials that will help you, and ask for a business card from the person you shadow.
  
- To document the time spent shadowing, the student will also complete ALL of the following tasks below:
  1. Use and submit the shadowing log you are given to record the number of hours spent “on the job.” (15 points)
  
  2. Create a six to eight (6-8) slide reflective PowerPoint that includes an overview of your shadowing experience and relates your thoughts about what you learned as a result of the shadowing experience. The PowerPoint should include where you went, who you shadowed, what you saw, what you did, what you liked/disliked, what you learned about the “business” and the person you shadowed, and what you learned about yourself (do you still want to/would you want to pursue this career choice... why or why not?). The PowerPoint must include at least one picture of you “on the job.” (35 points)
  
  3. Create a resume that could be used to when applying for a position at the “business” in which you completed your shadowing experience. (35 points)
  
  4. Write a thank you letter to the person you shadowed. (15 points)

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The Job Shadowing Project is due Monday, April 7, 2014 (A-Day) and Tuesday, April 8, 2014 (B-Day)

## VIRTUAL JOB SHADOWING

If you are unable to attend a “live” job shadowing experience because of personal issues, you may complete this project by “attending” a VIRTUAL JOB SHADOWING experience.

1. Visit the following web address:  
<http://www.careeronestop.org/Videos/CareerandClusterVideos/career-and-cluster-videos.aspx>
2. Since you will be unable to complete the entire required eight (8) hours with one person virtually, you will have to view at least ten (10) people in the cluster you decide to shadow. You will have to watch at least ten (10) videos of actual people working in their career choice. Take notes as you are viewing. You should also take the quiz for each of the videos viewed.

You will still have to complete the other requirements listed on the first page of this document.

1. Complete the shadowing log you are given to record when and how long you spend on the computer. (15 points)
2. Create a six to eight (6-8) slide reflective PowerPoint that includes an overview of your shadowing experience and relates your thoughts about what you learned as a result of the shadowing experience. The PowerPoint should include where you went, who you shadowed, what you saw, what you did, what you liked/disliked, what you learned about the “business” and the person you shadowed, and what you learned about yourself (do you still want to/would you want to pursue this career choice... why or why not?). The PowerPoint must include at least one picture of you “on the job.” (35 points)
3. Create a resume that could be used to when applying for a position at the “business” in which you completed your shadowing experience. (35 points)
4. Write a thank you letter one of the persons you shadowed. (15 points)

M. Haile  
Spring 2014

**JOB SHADOWING PROJECT AGREEMENT AND PERMISSION FORM**  
Keenan High School

Student Name(Print): \_\_\_\_\_ Block: \_\_\_\_\_

Parent/Guardian Name(s) (Print): \_\_\_\_\_

\*\*\*\*\*

**Student Contract**

I understand the **Job Shadowing Project** is a required assignment for all students enrolled in English III CP. I understand I must complete a minimum of eight (8) hours on the shadowing experience, create a reflective PowerPoint of the experience, create a resume for the career choice, and write a thank you letter to the person I shadow. I know that it is a privilege to participate and that people outside of school are giving up valuable time to help me learn about their jobs. Finally, I understand that if I can't make it to a scheduled shadowing because of an emergency situation, I will call the mentor in charge of the shadowing experience to reschedule. By signing this contract, I agree to complete all of the requirements of the **Job Shadowing Project**. I also understand that I am responsible for making up work in classes that I miss for my job shadow.

\_\_\_\_\_  
Student's Signature

\_\_\_\_\_  
Date

\*\*\*\*\*

**Parent/Guardian Contract and Permission**

I understand that all students enrolled in English III CP are required to complete a **Job Shadowing Project**. I understand it is my child's responsibility to arrange and complete the hours required for the **Job Shadowing Project**. I understand it will be my responsibility to provide transportation for my child on the day(s) in which he/she shadows (or to provide a location with a computer that has access to the internet). In addition, I release 1. Keenan High School and Richland County School District One, its agents and employees from any and all claims, liabilities, suits and causes of action arising from or related to my child's participation in the Job Shadowing Project, including travel to and from the job site. 2. and the business who decides to participate in the Job Shadowing Project, including but not limited to traveling to and from the job site, and any costs and expenses related to participation in the shadowing experience.

\_\_\_\_\_  
Parent/Guardian's Signature

\_\_\_\_\_  
Date

M. Haile  
Spring 2014

Student \_\_\_\_\_

### Job Shadowing Project Reflective PowerPoint Rubric

CATEGORY	4	3	2	1
<b>Text - Font Choice &amp; Formatting</b>	Font formats (e.g., color, bold, italic) have been carefully planned to enhance readability and content.	Font formats have been carefully planned to enhance readability.	Font formatting has been carefully planned to complement the content. It may be a little hard to read.	Font formatting makes it very difficult to read the material.
<b>Sequencing of Information</b>	Information is organized in a clear, logical way. It is easy to anticipate the type of material that might be on the next card.	Most information is organized in a clear, logical way. One card or item of information seems out of place.	Some information is logically sequenced. An occasional card or item of information seems out of place.	There is no clear plan for the organization of information.
<b>Effectiveness</b>	Project includes all material needed to gain a comfortable understanding of the topic. It is a highly effective study guide.	Project includes most material needed to gain a comfortable understanding of the material but is lacking one or two key elements. It is an adequate study guide.	Project is missing more than two key elements. It would make an incomplete study guide.	Project is lacking several key elements and has inaccuracies that make it a poor study guide.
<b>Spelling and Grammar</b>	Presentation has no misspellings or grammatical errors.	Presentation has 1-2 misspellings, but no grammatical errors.	Presentation has 1-2 grammatical errors but no misspellings.	Presentation has more than 2 grammatical and/or spelling errors.
<b>Listens to other presentations</b>	Listens intently; does not make distracting noises or movements	Listens intently, but makes one distracting noise or movement.	Sometimes does not appear to be listening, but is not distracting.	Sometimes does not appear to be listening, and makes distracting noises or movements.

Points Earned/Grade \_\_\_\_\_

Student \_\_\_\_\_

## Resume Rubric

Skill	Outstanding	Good	Average	Unsatisfactory	Total
<b>PRESENTATION/ FORMAT</b>	<input type="checkbox"/> Typed or computer generated <input type="checkbox"/> Balanced margins with eye appeal <input type="checkbox"/> Format highlights strengths and information <input type="checkbox"/> Appropriate fonts and point size used with variety	<input type="checkbox"/> Typed or computer generated <input type="checkbox"/> Balanced margins <input type="checkbox"/> Format identifies strengths and information <input type="checkbox"/> Appropriate fonts and point size used	<input type="checkbox"/> Typed or computer generated <input type="checkbox"/> Somewhat balanced margins <input type="checkbox"/> Format identifies strengths and information <input type="checkbox"/> No variation in fonts and/or point size	<input type="checkbox"/> Typed or computer generated <input type="checkbox"/> Unbalanced margins <input type="checkbox"/> Format detracts from strengths and information <input type="checkbox"/> Fonts distract from readability	
<i>Ranking Points</i>	10	8	7	6	
<b>JOB-SPECIFIC / VOLUNTEER INFORMATION</b>	<input type="checkbox"/> All action phrases used to describe duties and skills <input type="checkbox"/> Information demonstrates ability to perform the job <input type="checkbox"/> Professional terminology used when describing skills	<input type="checkbox"/> 1-2 duties/skills lack action phrases <input type="checkbox"/> Information demonstrates ability to perform the job <input type="checkbox"/> Some professional terminology used when describing skills	<input type="checkbox"/> 3-4 duties/skills lack action phrases <input type="checkbox"/> Some information demonstrates ability to perform the job	<input type="checkbox"/> 5-6 duties/skills lack action phrases <input type="checkbox"/> Information does not clearly demonstrate ability to perform the job	
<i>Ranking Points</i>	15	12	11	10	
<b>RESUME CONTENT</b>	<input type="checkbox"/> Heading, objective, skills, experience, and education covered in detail <input type="checkbox"/> Extra information given to enhance resume	<input type="checkbox"/> Heading, objective, skills, experience, and education covered in some detail <input type="checkbox"/> Extra information given to enhance resume	<input type="checkbox"/> Heading, objective, skills, experience, and education covered with little detail <input type="checkbox"/> Minimal extra information given to enhance resume	<input type="checkbox"/> Missing one of the following: heading, objective, experience, or education <input type="checkbox"/> No extra information given to enhance resume	
<i>Ranking Points</i>	15	12	11	10	
<b>SPELLING &amp; GRAMMAR</b>	<input type="checkbox"/> No spelling errors <input type="checkbox"/> No grammar errors	<input type="checkbox"/> 1-2 spelling errors <input type="checkbox"/> 1-2 grammar errors	<input type="checkbox"/> 3-4 spelling errors <input type="checkbox"/> 3-4 grammar errors	<input type="checkbox"/> 5-6 spelling errors <input type="checkbox"/> 5-6 grammar errors	
<i>Ranking Points</i>	10	8	6	4	

Points Earned/Grade \_\_\_\_\_

# **W. J. Keenan High School**



## **Senior Project**

**Alvin Pressley, Principal**

**Veronica Scott, Assistant Principal of C & I**

**Mary Haile, English IV Teacher**

**Anita Stroman, English IV Teacher**

# Keenan High School

## Senior Project

In the **SENIOR PROJECT** ALL graduating seniors prepare a project and present their work to a panel of interested adults during the second semester of their senior year.

Seniors will competently complete each of the **3 Ps (PAPER, PROJECT, and PRESENTATION)** in their **SENIOR PROJECT**.

**Each Senior will:**

1. Select an approved career or topic of interest and write **a five-six (5-6) page documented research paper.**

**\*\*As part of your research and project/presentation creation, you must obtain a mentor to assist in advising you throughout the project. Your mentor can be a teacher here at Keenan High School who agrees to be your mentor, a family member, or anyone over 21 years of age. Your mentor must be someone who is knowledgeable or a professional in the area of your interest.\*\***

The research paper must:

- a) Contain five (5) sources minimum. A personal interview counts as a source;
- b) Use Modern Language Association (MLA) documentation;
- c) Be five-six (5-6) typed, double-spaced pages in Times New Roman, 12 point font;
- d) Have one (1) inch margins;
- e) Contain a Works Cited page;
- f) Be a mixture of your words and quotes/paraphrases/summaries from your sources;
- g) Be free of plagiarism; and
- h) Be turned in on or before due date.

2. Apply the knowledge gained during your research by defining, designing, and producing **a related project.** For example, a student researching culinary arts could choose to shadow a baker/cook and create a dish(es) to display during his presentation.

Your project must:

- a) Document a minimum of ten (10) contact hours with mentor; a mentor time log is required, with mentor's signature for each contact.
- b) Be tangible or skill-based .
- c) Be related to research!!!!
- d) Be completed by YOU...NOT by your mentor or your parent

3. Formally speak to a board of judges from both the Keenan Faculty/Staff and the community during a **student led presentation** that is **accompanied by a visual**.

Your presentation must:

- a) Be at least five (5) minutes long. Presentations longer than five (5) minutes long will be penalized.
- b) Include a visual to enhance understanding of project product (poster, outline on flip chart, photo collage, PowerPoint, costume, something tangible).

Below is the tentative schedule for the completion of the SENIOR PROJECT.

Date(s)	Components
February 4 (A) February 5 (B)	Begin SENIOR PROJECT—Prewrite Sheet, Requirements, and Plagiarism
February 6 (A) February 7 (B)	Choosing a Topic, Evaluating Sources Documenting Sources, and Note & Source Sheets
February 10 (A) February 11 (B)	Topic Approval, Media Center (DISCUS and Media Center Sources with Mrs. Boyd), Begin researching (preparing note & source sheets)
February 12 (A) February 13 (B)	<b>**Issue and Preliminary Thesis Due**</b> Media Center (or Lab)—Research Days—Preparing Note & Source Sheets
February 14 (A) February 18 (B) February 19 (A) February 20 (B)	Media Center (or Lab)—Research Days—Preparing Note & Source Sheets
February 21 (A) February 24 (B)	<b>**Note and Source Sheets Due**</b> Thesis Statements Working Titles Title Page
February 25 (A) February 26 (B)	Proposal/Outline of Presentation
February 27 (A) February 28 (B)	Parenthetical Documentation Preparing Your Draft/Presentation Begin Draft
March 3 (A) March 4 (B)	<b>**Proposal Due**</b> Works Cited Media Center—Last In-class Research Days
March 19 (A) March 20 (B)	<b>**Rough Draft Due**</b> Teacher Conferences—Progress of SENIOR PROJECT
March 21 (A) March 24 (B)	Public Speaking/Presentation Skills
April 14-18	Spring Break—Work on your PROJECT!
April 24 (A) April 25 (B)	<b>**Research Paper Due at the <u>BEGINNING</u> of the block!!!! NO EXCEPTIONS!!!!**</b>

**\*\*Presentations will be scheduled on an individual basis. Presentations will begin the week of April 28, 2014.\*\***

Special Notes:

1. Use your time wisely! The due date for this project WILL NOT CHANGE!
2. The Media Center is open for your use. (Media Center Hours: Monday-Thursday; mornings beginning at 7:30 A.M. and after until 4:00 P.M.)
3. You are NOT allowed to print your paper in Ms. Haile/Mrs. Stroman's room on the day the paper is due!



# Keenan High School

## Senior Project

### Deadline and Plagiarism Policies

#### Senior Project Deadline Policy:

**Full credit is only given to Senior Project work turned in to the teacher before the tardy bell rings at the start of class** whether a student is in class or not. Assignments that are turned in on the due date but not at the start of class will receive no credit. This policy applies to students who arrive late to class, arrive after class has ended, fax the assignment after class has started, email the assignment after class has started, call the teacher after class has started, and/or place the assignment in the teacher's mailbox after class has started. Even when absent, a student is still responsible for getting the assignment turned in on time.

#### How to communicate IN CASE OF A DIRE EMERGENCY:

**Phone, email, fax. Any assignment turned in after the due date will receive zero credit.**

Remember, learning time management skills now will be very helpful to you in your future, no matter what you do.

**Senior Project Plagiarism Policy:** Any form of plagiarism will result in a zero for that

assignment, a referral to the dean, and a phone call to your parents. It is important to correctly cite all sources.

Common errors that are plagiarism:

1. A student uses a quote or another author's work without any citation.
2. A student paraphrases a quote or another author's work but does not cite the source.
3. A student incorrectly cites a source.
4. A student uses phrases and pieces of quotes without using quotation marks around them and / or does not cite them to their source.

Signing on the line below indicates you have read the deadline and plagiarism policies.

Signature of Student: \_\_\_\_\_

Print your name: \_\_\_\_\_

Teacher: \_\_\_\_\_ Period: \_\_\_\_\_ Date \_\_\_\_\_



Keenan High School

Dear Parents/Guardians:

Your senior will be completing a Senior Project this year. The purpose of this letter is to inform you of this major project that is being assigned to all seniors through their English class. This assignment, the Senior Project, has far-reaching potential for positively affecting students, not only while at Keenan, but well into the future. The major objectives are to bring together all of the skills that students have developed throughout their education, offer them an opportunity to expand that learning through a project which they choose and develop, and to assist them in presenting the fruits of their hard work in a presentation to the larger community beyond high school.

Please note that the Senior Project has three phases: the 3P's (the Paper, the Project, and the Presentation). First, a five-six (5-6) page **Research Paper** requires students to complete substantial research in a variety of formats, to organize that information into a convincing and thorough essay, to manage their time so to correct errors, revise, and finally to produce a polished paper. There is a broad range of topics that may be pursued; the student's own desire and interest determine the topic.

The second phase is the **Product** component. Here, the student takes advantage of the information gained during research, chooses someone who is highly knowledgeable in that particular field to serve as a mentor, and then spends a minimum of ten (10) hours pursuing some activity for which there will be a final result or product.

The third component is the **Presentation**. This is an oral report of five (5) minutes before a panel of community judges. These volunteer judges (panelists) are maybe teachers, parents, Richland One Board Members, high tech employees, policemen, independent business persons, mentors and various other members of our community. We welcome you to serve as a panelist for our Oral Presentations as well.

All of the guidelines for the Senior Project will be distributed through your student's English class. We do ask that you support your child in any way possible. One of the most important features of the Senior Project is the lesson it teaches in self-discipline, responsibility, integrity, and time management. We expect this to be a challenging yet extremely rewarding project, one which will be a crowning culmination of your teen's entire school experience. We invite your involvement.

Sincerely,

Ms. M. Haile, Senior AP English and Literature

Mrs. A. Stroman, English IV CP

**Keenan High School**  
**Senior Project**

Parent Permission Form

Student's Name \_\_\_\_\_

Parent's Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_

Parent's Phone: Home \_\_\_\_\_ Work \_\_\_\_\_

As a parent/guardian of \_\_\_\_\_, a senior at W. J. Keenan High School, I am aware that my son/daughter must pass all portions of the Senior Project in order to graduate in May 2014.

For the project, my son/daughter has chosen to: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

My son/daughter has chosen \_\_\_\_\_ to be his/her Outside Mentor for Senior Project. The above named Mentor has agreed to the responsibilities outlined in the Outside Mentor Agreement form and letter.

In the course of this project, your child's image and voice may be recorded on video, and your child may be photographed. Photographs and videos may be used to display aspects of the project to stakeholders. No student's last name will appear on an materials displayed.

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He/she HAS \_\_\_\_\_ DOES NOT HAVE \_\_\_\_\_ (check one) my permission to complete this project, and I agree to release W. J. Keenan High School, Richland County School District One, and its employees from all claims arising from financial obligation incurred, or damage, injury, or accident suffered while my son/daughter participates in the project that he/she has chosen.

I DO \_\_\_\_\_ DO NOT \_\_\_\_\_ (check one) authorize my son/daughter to meet his/her outside mentor off-campus for the purpose of working on Senior Project.

I DO \_\_\_\_\_ DO NOT \_\_\_\_\_ (check one) give permission for my child's image and voice to be recorded and for photographs of my child to be taken.

Parent/Guardian Signature: \_\_\_\_\_

Student Signature \_\_\_\_\_

Date: \_\_\_\_\_



# Keenan High School

## Senior Project

### Project Proposal

Student's Name \_\_\_\_\_ Date \_\_\_\_\_

#### PRODUCT

What is your Senior Project? What is the physical product you will create to show the judges? Be specific.

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What steps will you take to complete this product?

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How will you keep track of your process of creating the product?

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#### PAPER

What are you researching for your paper? Be as specific as possible.

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#### PROJECT

How is this project a stretch for you? What challenges will you face?

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When the project is completed, what will you have learned?

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APPROVAL Signature \_\_\_\_\_ Date \_\_\_\_\_

\*\*\*You must TYPE your Senior Project Proposal\*\*\*

## **Final Report for Genes and Genealogy Project**

### **Section 1: Basic Information**

1. School Name: W.J. Keenan High School
2. Project Director's Name: Kirstin Bullington
3. School Address: 361 Pisgah Church Road, Columbia, SC, 29204
4. Official Project Title: Genes and Genealogy Project
5. Official Project Dates: August 2012- June 1, 2013
6. Approved Total Budget: \$4,794.00

## Section 2: Final Financial Report

A. Line Items	B. Proposed Expense	C. Actual Expense
DNALC Human Mitochondrial DNA Extraction, Amplification, and Electrophoresis Kit with Carolina BLU Stain (16)	2813.28	<b>3281.05<sup>1</sup></b>
Eppendorf Digital Pipet, Series 2100, Clear Tip, 0.5-10 µL (3)	1116.82	<b>1138.27<sup>2</sup></b>
Micropipet Tips, Clear, Generic, 0.5-10 µL, Case of 960 (2)	179.90	<b>173.23<sup>3</sup></b>
Genewiz analysis of mtDNA samples (educational discount, \$3.00/sample)- Qty 288	864.00	<b>273.00<sup>4</sup></b>
<i>Shipping, FedEx Overnight, Samples to Genewiz for Sequencing (2- \$50.96 each)</i>	-	<b>101.92<sup>5</sup></b>
<i>Micropipet tips, sterile, 100-1000 µL/ 100 (4)</i>	-	<b>70.62<sup>6</sup></b>
<i>Carolina Replacement Deluxe Gel Tray</i>	-	<b>42.80<sup>7</sup></b>
<i>Sterile Transfer Pipet, Pack of 100</i>	-	<b>35.31<sup>8</sup></b>
<i>Microcentrifuge Tubes, 1.5 mL, Pk of 1000 (3 needed for each sample)</i>	-	<b>56.66<sup>9</sup></b>
<i>Centrifuge tubes, 15 mL (Pk of 50- 7)</i>	-	<b>262.15<sup>10</sup></b>

<sup>1</sup> Between the time of the original proposal (August 2011) and the time the materials were ordered once funds cleared the district financial services (November 2012), the price of the mtDNA kits and Eppendorf Digital Pipets increased. Please see attached quote from Carolina Biological Supply (Appendix A).

<sup>2</sup> See explanation above regarding mtDNA kits and Eppendorf Digital Pipets

<sup>3</sup> Between original proposal and time materials were ordered, the price of the micropipets decreased slightly in the quote.

<sup>4</sup> The number of samples sent for sequencing has been fewer than anticipated due both to longer times to extract and amplify the DNA and budgetary limits. The remainder of the estimated sequences will be sent during the freshmen summer camp 2013 and the fall of 2013 school year in order to fulfill the numbers of students reached as proposed- please see Section 4 for further explanation.

<sup>5</sup> The cost of shipping samples to the sequencing service was omitted from the original proposal and was covered by teacher discretionary funds and school science and engineering budget.

<sup>6</sup> Upon receiving the mtDNA kits, there were several items not included in the kits that were needed to complete this project- Micropipet tips for the 100-1000µL pipet (school already owned pipet itself), Centrifuge and microcentrifuge tubes for extraction of DNA from epithelial cheek cells, additional transfer pipets, and replacement gel trays for the electrophoresis chamber. These expenses were not anticipated in the proposal as previous kits purchased by the project manager included all necessary apparatus. Expenses exceeding the original grant were covered by the school science and engineering budget.

<sup>7</sup> See footnote #6

<sup>8</sup> See footnote #6

<sup>9</sup> See footnote #6

<sup>10</sup> See footnote #6

<b>TOTAL</b>	<b>\$4974.00</b>	<b>\$5435.01</b>
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The following statement must be signed and dated by the financial officer:

*"I attest to the fairness and accuracy of this financial report and have explained any difference between the proposed and actual expenses."*

\_\_\_\_\_  
Signature on hard copy in mail

Financial officer Signature      Title      Telephone      Date

### **Section 3: Planned vs. Actual Outcomes**

**Objective 1: By the end of the 2012-2013 school year, 80% or more of the biology students at W.J. Keenan High School will show proficiency (70% or higher) on the South Carolina End of Course Examination Program (EOCEP).**

**Indicator 1a: Percent of students passing the South Carolina Biology EOCEP in May 2013 (as defined by the South Carolina State Department of Education, achieving 70% or higher):**

**57% (122/213 students tested)**

**Indicator 1b: Percent change in passing rate of the South Carolina Biology EOCEP from 2012 to 2013.**

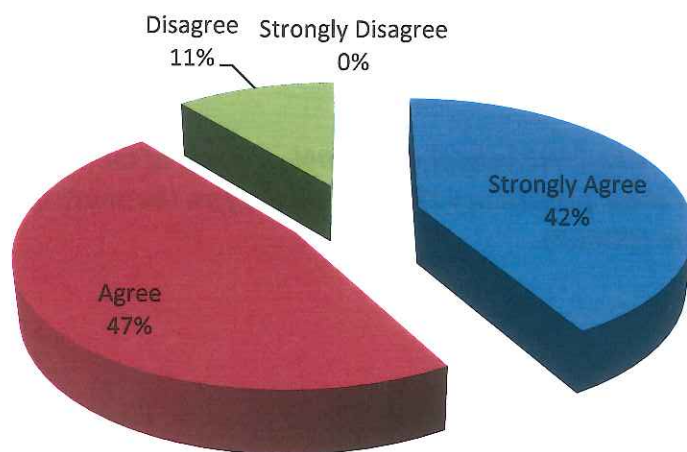
**-12% (2012 pass rate: 69%)**

**Objective 2: By the end of the 2012-2103 school year, as a direct result of participating in the Genes and Genealogy Project, 80% or more of the biology students at W.J. Keenan High School will demonstrate an increased interest in studying science.**



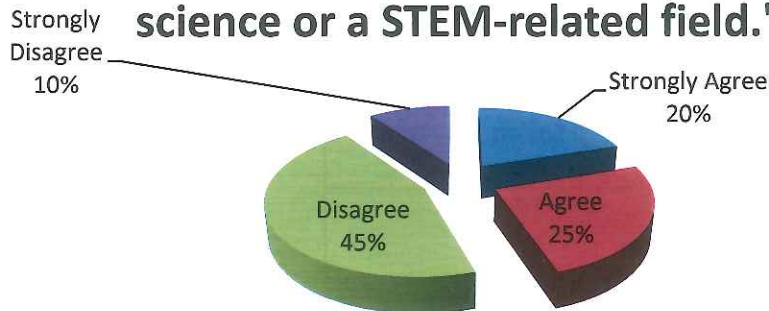
*Indicator 2a: Percent of biology students expressing interest in biology on post project KAP surveys (Knowledge, Attitude, and Perceptions) and/or journal entries.*

**Indicator 2a: Student Responses to the following question on post-KAP survey, "As a result of completing this project, I have a greater interest in studying biology."**



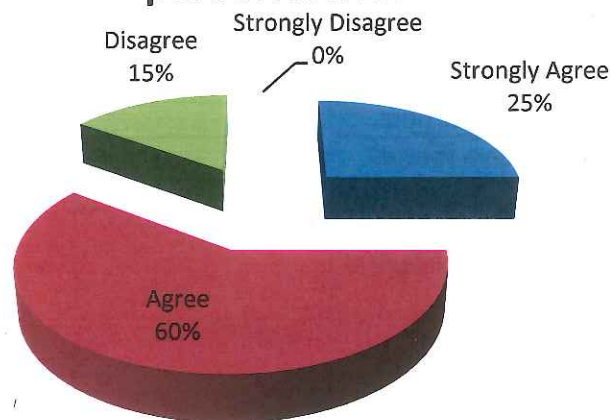
*Indicator 2b: Percent of biology students expressing a desire to pursue a career in science on post project KAP surveys and/or journal entries.*

**Indicator 2b: Student responses to the following question on post-KAP survey, "As a result of completing this project, I am interested in pursuing a career in science or a STEM-related field."**



*Indicator 2c: Percent of biology students identifying a strong relevance of biology to their own lives on post project KAP surveys and/or journal entries.*

**Indicator 2c: Student Responses to the following question, "As a result of completing this project, I have a clearer understanding of how biology relates to my personal life."**



## Section 4: Evaluation

Based on the overall academic indicator results, the success of the project would appear questionable. However, as project manager I did a further breakdown of benchmark scores from the 2011-2012 and 2012-2013 school years for the specific state standards for which the Genes and Genealogy project aligned. The following is a table of percent improvement in each of the standards indicated on the final proposal:

Indicator	Description	Percent Change in Mastery between 2012 and 2013 Spring benchmarks <sup>11</sup>
B-2.2	Summarize the structures and functions of organelles found in a eukaryotic cell.	+ 2%
B-2.3	Compare the structures and organelles of prokaryotic and eukaryotic cells	-8%
B-3.2	Summarize the basic aerobic and anaerobic processes of cellular respiration.	-5%
B-4.1	Compare DNA and RNA in terms of structure, nucleotides, and base pairs	+17%
B-4.2	Summarize the relationship among DNA, genes, and chromosomes	+19%
B-4.3	Explain how DNA functions as the code of life and the blueprint for proteins	+5%
B-4.8	Compare the consequences of mutations in body cells with those in gametes.	+7%
B-4.9	Exemplify ways that introduce new genetic characteristics by applying the principles of modern genetics,	-6%
B-5.2	Explain how genetic processes result in the continuity of life forms over time.	+11%
B-5.3	Explain how diversity within a species increases the chances of its survival	-2%
B-5.4	Explain how genetic variability and environmental factors lead to biological evolution	+10%
Average Change		+4.5%

<sup>11</sup> As reported by [www.usatestprep.com](http://www.usatestprep.com) comparison of identical benchmarks, Spring 2012-Spring 2013

In summary, I think that there was a direct correlation between participation in this project and the understanding of how DNA functions, which may not have been indicated in the end of course pass rate, as individuals only receive an overall score, with no indication of how students fared on each standard. Furthermore, the success in terms of personal relevance to biology cannot be underestimated, as this particular cohort of biology students was a challenge to engage. Therefore, given that Objective 2 was met for two of the three indicators, despite a regression in test scores, I believe the Genes and Genealogy project could be considered successful.

In addition, although this is a final report, I do not consider the project to be complete, as we did not meet our target numbers in terms of participation and sequencing. Although 223 students participated, only 126 have had their DNA sequenced, due to delays and unexpected increases and expenses. We will be sequencing additional samples in the fall, and we have sufficient materials to allow the next group of freshmen to participate as well- the cost of which will be covered by the science and engineering budgets.

## Section 5: Observations

- *Were there any surprises or unexpected outcomes?*

To be completely honest, when I reviewed my class rosters in August, I had serious misgivings about the efficacy of this project. When I wrote the Genes and Genealogy Project Proposal in 2011, it was with the understanding that I would have a mid-sized biotechnical engineering class and two honors sections of Biology I. This year, my biotechnical engineering class was extremely small (3 students) due to scheduling conflicts, and instead of honors and college preparatory biology, I had three sections of Biology I A, and two sections of Biology I, of whom 60% were remedial students. As we waited for the funds to clear district procedures in the fall, I became more and more worried about completing this project, given the literacy challenges my students faced and their apathy for biology class, lab included.

When we started this project in February, I initially experienced the same resistance from many of my biology students in terms of interest and completion of assignments, including getting their DNA permission slips signed. The first day of DNA extraction, however, was absolutely amazing. Although I had to do more guidance than anticipated, and the process went much smoother, my students responded to doing the rather challenging lab work, because they saw it as “real” science. Students who had refused to even walk back to the lab tables at other times were asking to take pictures of themselves using the micropipets and centrifuge to post on Instagram. This project completely changed their view of molecular biology from an abstract

and boring concept to a dynamic opportunity. Every day, I was asked multiple times, "Do you have our DNA sequences?"

As the results returned, I discovered that following the directions to come to individual conclusions about ancestry was more challenging for my students, so I sat with them individually and helped them construct phylogenetic trees to determine maternal ancestry. This unexpected hurdle actually became one of the more enjoyable aspects of the project for me: I had the opportunity to sit with each student and talk about their mother's family with them, and make sure they were comfortable with what their mtDNA sequences suggested. If not, we discussed possible errors and other explanations for why their anecdotal family history might differ from what their mtDNA suggested (back mutations, contamination in sampling, etc). In this way, what was first an obstacle in terms of difficulties in drawing adequate conclusions from data became an opportunity for both interactions with my students and prevention of misunderstandings from participating in the project.

- *In what way were you, your students, your colleagues, and your school made different because of the project?*

As a school, this project enabled us to engage one of the more challenging freshman classes that we have seen- the World Geography instructor included discussion of the project and their results in their lesson on human migration. I fielded a lot of questions about the project from my colleagues based on the discussion the students had with each other in other subjects, including showing off their mtDNA sequences and phylogenetic trees. Many were eager to place stars on the world map in my classroom to indicate their maternal line. From the post-project KAP survey, I was fairly astounded at how many of them agreed or strongly agreed with the relevance of biology to their personal lives, and I have to largely credit this project, as even the students who were the most resistant to class engagement changed their minds and begged to participate when their peers' DNA results came back.

As an instructor, this experience has been invaluable to me, for it has made me realize that I must include biotechnology activities such as this one in all of my courses, and to not be intimidated by low engagement and/or literacy levels. The mitochondrial DNA lab is considered to be an advanced high school and college activity; however, students with reading levels as low as second and third grade were able to follow oral directions and make meaningful personal connections to biology. Furthermore, based on my experiences with this project in both the biotechnical engineering class and my Biology I classes, I plan on routinely requiring my upperclassmen to assist or teach the freshmen certain lab skills, for that was an extremely successful aspect of this project. The biotech students enjoyed assisting the freshmen and improving their own laboratory accuracy; at the same time, the freshmen infinitely preferred

asking the upperclassmen questions rather than asking me to explain a concept again. Based on the overall success of the project, I have been asked to submit a lesson plan for consideration as the biotechnical engineering course is revised over the next few ways. In that way, this project may have a greater impact than just at our school.

## Section 6: Examples of Student Work

The following are some photos of work within the project, as well as some student quotes taken from the post-project KAP survey comments section. Additional materials include a preliminary web quest (biotechnical engineering), student-generated phylogenetic trees, and pedigrees (both Biology I students).



Figure 1: Materials purchased for Genes and Genealogy Project

### Student Responses to the question, "What did you learn from the Genes and Genealogy Project?"

"How to extract mtDNA, How PCR works, What mtDNA can be used for, How it can be used to compare individuals" -S.M., Grade 11

"It was a lot of fun. Also my family started somewhere in southern Africa" -B.C., Grade 9

"I learned more about my DNA and how it used to compare individuals." -B.S., Grade 9

"I learned that my closest possible ancestor is from Spain." - D.D., Grade 9

"That i am related to alot of different races that i didn't even know that i was related to. like i never knew that i was related to people from england or nigeria (sic)" - J.S, Grade 9

"How to separate the cells and use phylogenetic trees" - D.D, Grade 9

"Someone has close genes [to me] in Algeria," -J.J., Grade 12

"I've learned how to read a phylogentic tree more well also the fact that we all realited to some some where at some point (sic)" -M.W., Grade 9

"I learned where I was from and hope to look more forward to genetics and genes from where I come from" - B.B. Grade 9



Figure 2: Biotechnical engineering students extracting mtDNA from their cheek cells.



Figure 3: Biotech students preparing gels to confirm presence of mtDNA (they got really good at this!)

Figure 4: Preparing mtDNA samples to be amplified through PCR (right)



for electrophoresis with mtDNA samples (left)

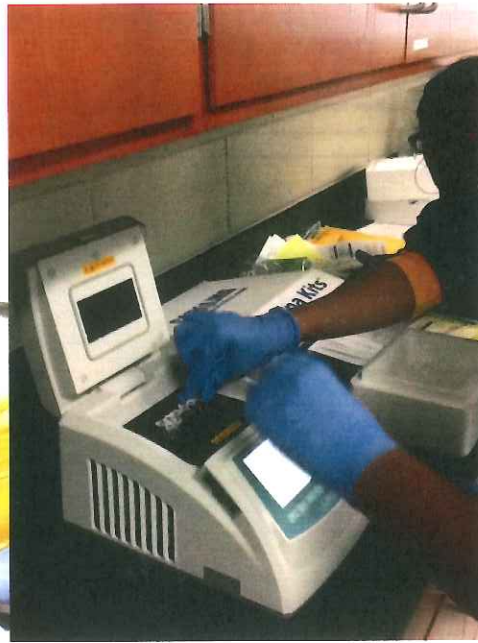


Figure 5: Loading gel

Figure 6: Sample gel confirming successful extraction and amplification of mtDNA samples (below)

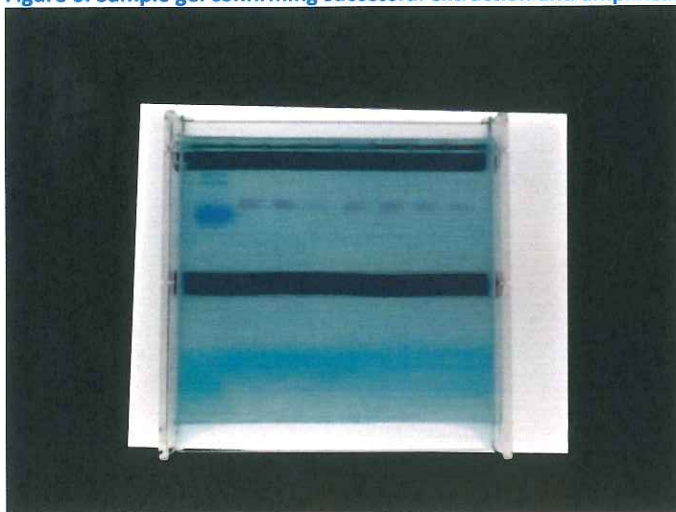




Figure 7: Comparing nucleotides of mtDNA sequence to known modern human sequences

ClustalW Sequence Alignment - FrontMotion Firefox

http://www.bioservers.org/html/sequences/clustalw.html?output=865,87116,ebpEgn35aHn,&source=4,11,12,8myseqs

**CLUSTAL W ALIGNMENT**

Your sequences have been sent to a server at Cold Spring Harbor Laboratory for alignment; they will be displayed momentarily.

Alignments are displayed in blocks of 25 nucleotides per row. Mismatches are colored in yellow. Positions containing a sequencing error (N) are colored in grey. Dashes (-) denote misalignments.

```

England_#3      ATTTGCTACATTACTGCCAGCCACC
Nuu-Chah-Nulth_#3 ATTTGCTACATTACTGCCAGCCACC100
kb05           ATTTGCTACATTACTGCCAGCCACC

England_#3      ATGAATATTGTACAGTACCATAAAT
Nuu-Chah-Nulth_#3 ATGAATATTGTACAGTACCATAAAT125
kb05           ATGAATATTGTACAGTACCATAAAT

England_#3      ACTTGACCACCTGTAGTACATAAAA
Nuu-Chah-Nulth_#3 ACTTGACCACCTGTAGTACATAAAA150
kb05           ACTTGACCACCTGTAGTACATAAAA

England_#3      ACCCAATCCACATCAAAAACCCCTC
Nuu-Chah-Nulth_#3 ACCCAATCCACATCAAAAACCCCTC175
kb05           ACCCAATCCACATCAAAAACCCCTC

England_#3      CCCATGCTTACAGCAAGTACAGCA
Nuu-Chah-Nulth_#3 CCCATGCTTACAGCAAGTACAGCA200
kb05           CCCATGCTTACAGCAAGTACAGCA

England_#3      ATCAACCTCAACTATCACACATCA
Nuu-Chah-Nulth_#3 ATCAACCTCAACTATCACACATCA225
kb05           ATCAACCTCAACTATCACACATCA

England_#3      AGTGCACCTCCAAAAGCCACCCCTCA
Nuu-Chah-Nulth_#3 AGTGCACCTCCAAAAGCCACCCCTCA250
kb05           AGTGCACCTCCAAAAGCCACCCCTCA

England_#3      CCCACTAGGATACCAACAAACCTAC
Nuu-Chah-Nulth_#3 CCCACTAGGATACCAACAAACCTAC275
kb05           CCCACTAGGATACCAACAAACCTAC

England_#3      CCACCCCTTAACAGTACATAGACAA
Nuu-Chah-Nulth_#3 CCACCCCTTAACAGTACATAGACAA300
kb05           CCACCCCTTAACAGTACATAGACAA
    
```

Done

ClustalW Sequence Alignment - FrontMotion Firefox

http://www.bioservers.org/html/sequences/phylo.html?output=8581,848,865,867,87114,87115,87116,ebpEgn35aHn,&source=0,1,4,5,9,10,11,12,8myseqs

**CLUSTAL W ALIGNMENT**

Your chosen sequences have been sent to a CLUSTAL W server at Cold Spring Harbor Laboratory for tree generation.

Tree Style: Cladogram Use lengths?  Yes  No

```

graph LR
    Root --- Node1
    Node1 --- England_#1
    Node1 --- Node2
    Node2 --- England_#3
    Node2 --- Node3
    Node3 --- kb05
    Node3 --- Node4
    Node4 --- Nuu-Chah-Nulth_#4
    Node4 --- Node5
    Node5 --- Nuu-Chah-Nulth_#3
    Node5 --- Node6
    Node6 --- Eastern_Pygmie
    Node6 --- Node7
    Node7 --- Yoruba_#4
    Node7 --- England_#2
    
```

Aligning sequences...

Done

Figure 8: Constructing phylogenetic trees from modern human samples

M. Haile

Unit Proposal—African American Studies (4<sup>th</sup> Block, B-Day)

The African American Studies class is being taught chronologically. As a result, so far the following concepts have been facilitated:

- What do the words African American make you think?
- The continent of Africa (the home of African Americans)
- African Literature (proverbs and folk tales)

In the next two weeks, the students will study:

- The transportation of Africans to America
- Spirituals
- Slave Narratives

After this beginning, it is proposed that the teacher begins the “Roots Unit.” The Roots Unit will consist of the following components:

Unit Component	Cross Curricular Focus
An author study—Alex Haley	Literature focus—studying an author
A complete viewing of the TV miniseries, <i>Roots</i>	Literature focus—based on Haley’s novel, <i>Roots</i> Writing focus—students will complete analysis questions and reaction papers while viewing Social Studies/History focus—the miniseries/novel were based on historical events
A “My Roots” project	Social Studies/History focus—Family tree Literature/Writing focus—creation of poems Students will: <ol style="list-style-type: none"><li>1. Create a family tree for your family. Make a creative visual (on poster board) to share with their classmates.</li><li>2. Write a two poems:<ol style="list-style-type: none"><li>a. About a favorite family member</li><li>b. About a favorite/most memorable family gathering</li></ol></li></ol>
A mDNA activity with Mrs. Bullington’s assistance	Science focus—extracting DNA and finding out the maternal lineage
A viewing of Oprah’s interview with the cast of <i>Roots</i>	Literature focus—impact of the novel/miniseries on the American population

This unit will lead to the next major unit in African American Studies, the Civil Rights Movement.



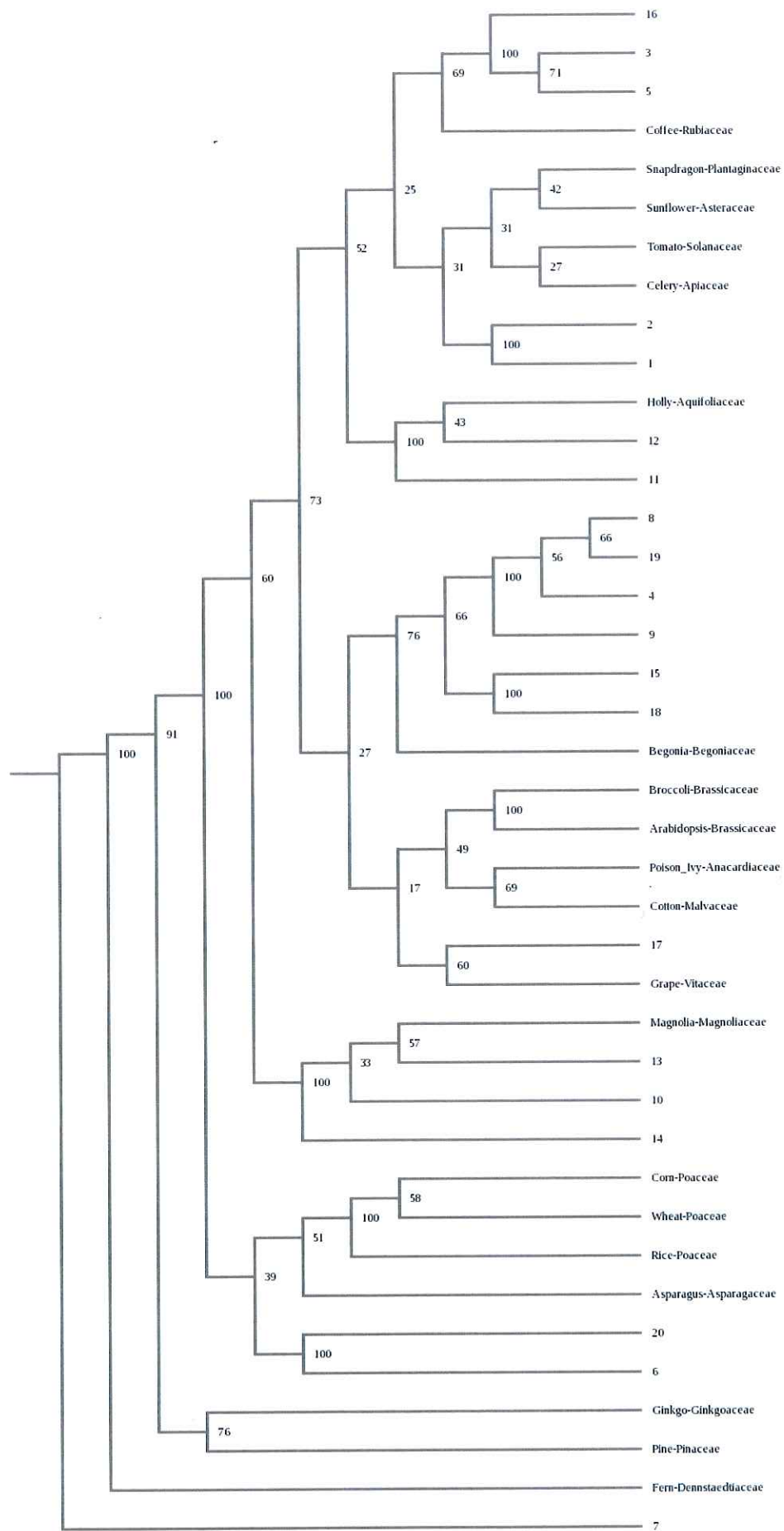
**Strong Schools  
Grant Program**

**Colonial Life Strong Schools Grant Program  
2013-2014 School Year**

**Follow-up Summary Form**

**NOTE: This form must be completed and returned by May 30, 2014 in order to apply for future grants through this program.**

<b>Name: Kirstin Bullington</b>
<b>Email: kbullington@richlandone.org</b>
<b>School: W.J. Keenan High School</b>
<b>Grade Level(s) Targeted: 9</b>
<b>Amount Awarded: \$ 1,000</b>
<b>Actual Funds Used: \$ 1,173.97 (additional materials and sample sequences purchased through teacher supply funds)</b>
<b>Project or Lesson Title: Using DNA Barcoding to Determine Local Biodiversity</b>
<b>Number of Students Served: 55</b>
<b>Describe the activities implemented through this grant funding. If different from your proposed plans, please explain.</b>
<p>Freshmen students collected leaf samples of various trees on the Keenan campus, extracted the rbcL gene from the chloroplasts, then amplified the gene through PCR. After presence of DNA was confirmed via gel electrophoresis, samples were sent off for DNA sequencing, which the students used to determine the species of the tree via DNA subway (a iPlant collaborative bioinformatics site). Several of the students enjoyed the process so much that they made DNA sequencing a key component of their ecology inquiry projects (comparing species of nursing logs to the ground, comparing DNA of large and small individuals, and comparing DNA of thorned vs. non-thorned plants). Students were also able to determine the amount of carbon dioxide sequestered by their sample trees using the USDA Tree Carbon Calculator. Three senior students in biotechnical engineering used their data, as well as their own (using materials not purchased through the grant), to write an ontology-driven simulation to model the effects of individual species on local carbon dioxide levels.</p> <p>The only change to this project from the original focus was exclusively concentrating on plant species; the students decided that they preferred collecting leaves to insects.</p>
<b>What results were gained by implementing your project?</b>
<p>A total of 80 samples were sent for sequencing, identifying 23 different plant species in the wooded areas of the Keenan campus, including sweetgum, peach, dogwood, and magnolia trees, as well as loblolly and short leaf pine. Project success was measured by academic achievement. Using the prior year's biology class as a control, students who participated in this project increased their passage rate on the biology End of Course Exam by 27%. Specifically, all four biology indicators that identified in the project proposal showed gains in mastery from pre-project assessment to post-project assessment.</p> <p>The following is a phylogenetic tree produced from students' DNA samples, compared to some common plant species:</p>



**How would you improve this project?**

The only thing I would suggest for improvement would be to move the timeline forward; for DNA sequencing, it is best to use living tissue, and we had to wait until the spring to collect appropriate specimens. If the grant could be started in early fall, or awarded in the spring with funds being released in the fall, it might be easier for project implementation.

**Applicant's Signature:**

**Date:**

**Mail or e-mail completed follow-up form and photo (if available) to:**

Marie McGehee  
Colonial Life  
1200 Colonial Life Blvd.  
Columbia, SC 29210  
E-mail: [ammcgehee@coloniallife.com](mailto:ammcgehee@coloniallife.com)  
Phone contact: 803-678-6427



Figure 1: Sample collection, quadrat 1

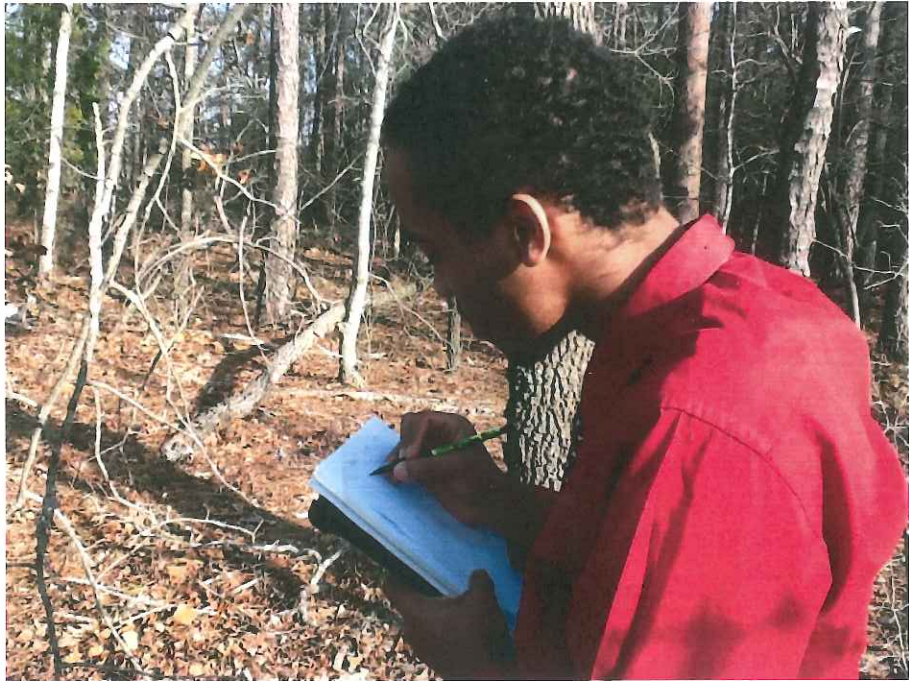


Figure 2: Quadrat 2



Figure 3: Determining d.b.h, quadrat 3



Figure 4: Extracting DNA from leaf samples

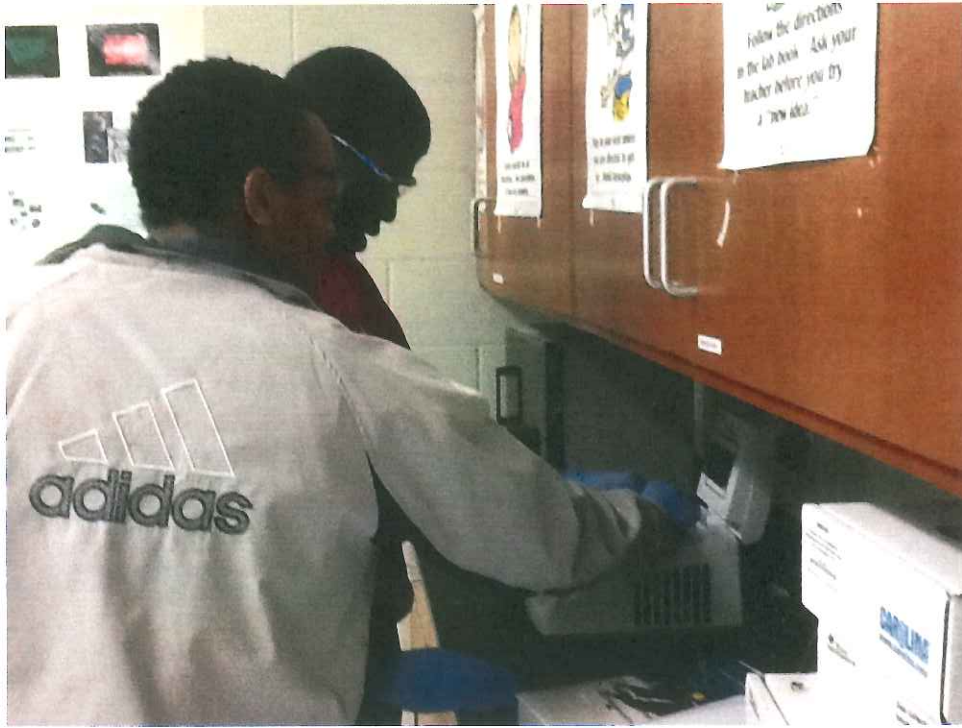


Figure 5: Loading samples into thermal cycler for PCR

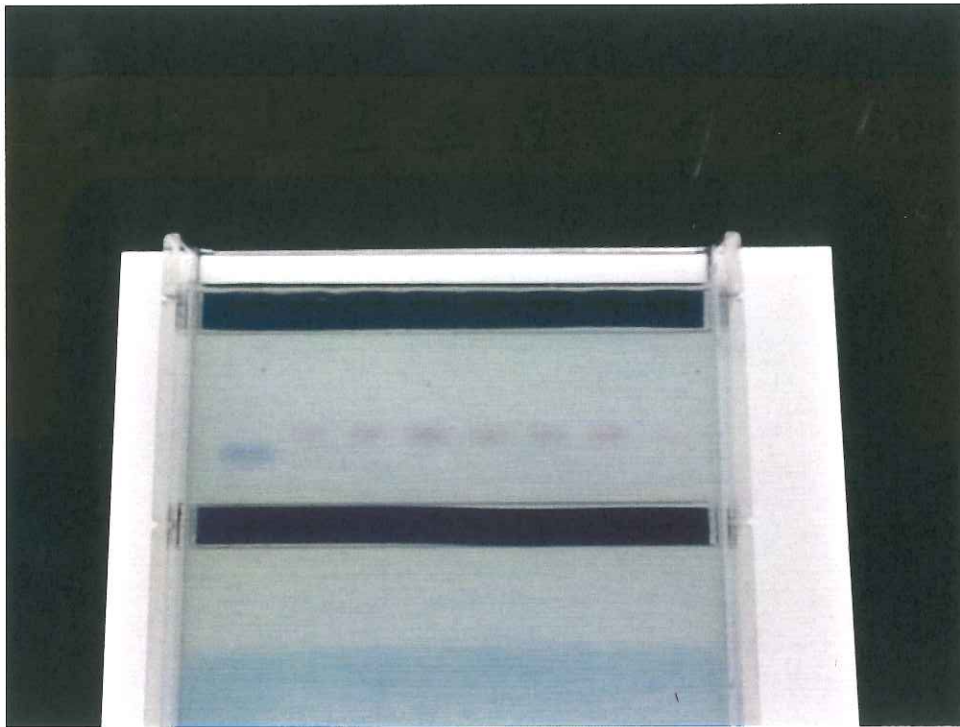


Figure 6: Gel of DNA samples after amplification by PCR