

Engaging Underserved High School Students in Science Investigations using NASA’s GLOBE and GLOBE Observer Resources.

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Abstract

Engaging high school students in authentic scientific investigations is essential for increasing scientific literacy. Teachers often resort to using textbooks and in-class laboratory experiences that emphasize facts but leave students feeling disengaged. Additional challenges are often added to trying to teach STEM content effectively to students for whom English is not their first language. A collaborative partnership between the author, a former educator who now is an Education and Outreach Specialist with NASA, and a high school teacher who works with underserved students for whom English is not their native language, was formed in order to offer authentic STEM experiences in a public-school setting. They explored the many resources within The GLOBE Program and the GLOBE Observer app, and decided to use these to build the structure around an elective STEM course for 11th grade students. Students learned how NASA satellite data is being used to better understand Earth’s systems and to gather data to help us monitor our changing climate. They used the GLOBE Observer “tools” (Mosquito Habitat Mapper, Trees, Land Cover) as well as several GLOBE atmosphere protocols (precipitation, air temperature, relative humidity, soil moisture) to monitor ongoing environmental conditions. Students formed investigative teams and worked with NASA scientists and data as they designed and conducted research to explore the impact of environmental conditions on active mosquito seasonality and types of mosquitoes, tree growth, and land cover in their schoolyard. They also communicated regularly with other students who were collecting similar data in different countries around the world to compare and contrast the impact of these environmental variables. The goal is for students to submit their research results to GLOBE’s “International Virtual Science Symposium” and also share their projects at their county-level science fair.

Engaging Teachers and Students in IVSS Projects

Mercy Molina, a high school teacher at the International School at Largo in the Prince George's County Public School system, worked with me during the summer 2019 to learn how to use the GLOBE Observer app and to take the online e-Training courses. She wanted to engage her English as Second Language learners in using authentic scientific investigations, and felt The GLOBE Program would be a good match. We worked together to develop a curriculum that would be meaningful and relevant for her 11th and 12th grade students.





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Semester 1 STEM and GLOBE

Course Overview:
 The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and contribute meaningfully to our understanding of Earth's systems and life on Earth. <https://www.globe.gov/en/about/overview>
 The GLOBE Program provides a meaningful connection to the real-world applications of STEM. It uses Technology and Engineering tools to collect real data and uses Math to analyze and interpret these data. The use of GLOBE App Observer itself is a handy application of STEM.

This program is free, serving students, teachers, and scientists around the world. Many of the resources are available in multiple languages, and there are over 120 countries who are actively involved with this program. Students will collect data from their schoolyard-precipitation, temperature, and other important environmental variables. They will learn how and why scientists collect these and other data to better understand Earth's interacting systems. GLOBE students, educators, and scientists collaborate to ask questions about how the world works, plan and carry out investigations, and use all of the other practices of science to gain a better understanding of Earth systems. GLOBE students conduct investigations of their own local area as they build their understanding of core ideas and crosscutting concepts.

NGSS Standards
HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
HS-ESS2-3. Construct an argument based on evidence about the simultaneous co-evolution of Earth's systems and life on Earth.
SEP: Developing and Using Models
DCI:ESS2.A. Earth Materials and Systems
CC: Energy and Matter
 Detailed description of NGSS alignment please click the link.
<https://high-school.globeobserver.org>

Mastery Project: By the end of this semester, the students will:
 Complete a research paper for the IVSS ("Virtual Science Symposium Student Research")

Semester 1	Approximate Length of Unit	Overarching/Essential Questions
STEM and GLOBE	1 semester	How do scientists collect, analyze and interpret data to explain and communicate findings about Earth's systems?

Overarching Critical Thinking Skills Assessed (Highlight)	Overarching Socioscientific Skills Assessed (Highlight)	Overarching Language Functions (Highlight)
- Summarize - Propose a Claim - Interpret Information - Reflect & Revise - Analyze Data - Model - Compare & Contrast - Analyze Information	- Relationships - Reasonable Decisions - Self Management	- Compare/Contrast - Propose a Claim - Cause and Effect - Sequencing - Classify - Describe - Others...

Students learned about The GLOBE Program and GLOBE Observer using webquests with links to a variety of resources. They were interested in studying mosquitoes as a few in the class had been sick with mosquito-transmitted diseases in the past and they found them fascinating. They also collect data daily using GLOBE atmosphere protocols, which they then use to help determine when conditions will be in place for active mosquito season.



The students are researching the following investigative questions:

- What kinds of mosquitoes are found in our region?
- When are these mosquitoes most likely to be active?
- Has the length of the active mosquito season changed for our region in the past two decades?
- What kinds of mosquito-transmitted diseases have been reported in our region?
- What are the most effective protection and prevention methods for reducing the threat of mosquito-transmitted disease in our region?



The students are collecting data and conducting research now, and plan to submit International Virtual Science Symposium (IVSS) reports at the end of the the semester. They will present the results of their research to the school administration and other students at their school.

Mercy Molina is in the process of developing a new course outline that would allow the students to earn credits as an environmental elective class.

Engaging Underserved High School Students in Authentic Investigations Using The GLOBE Program

Dorian Janney, ADNET/GSFC GLOBE Mission Mosquito Campaign Coordinator

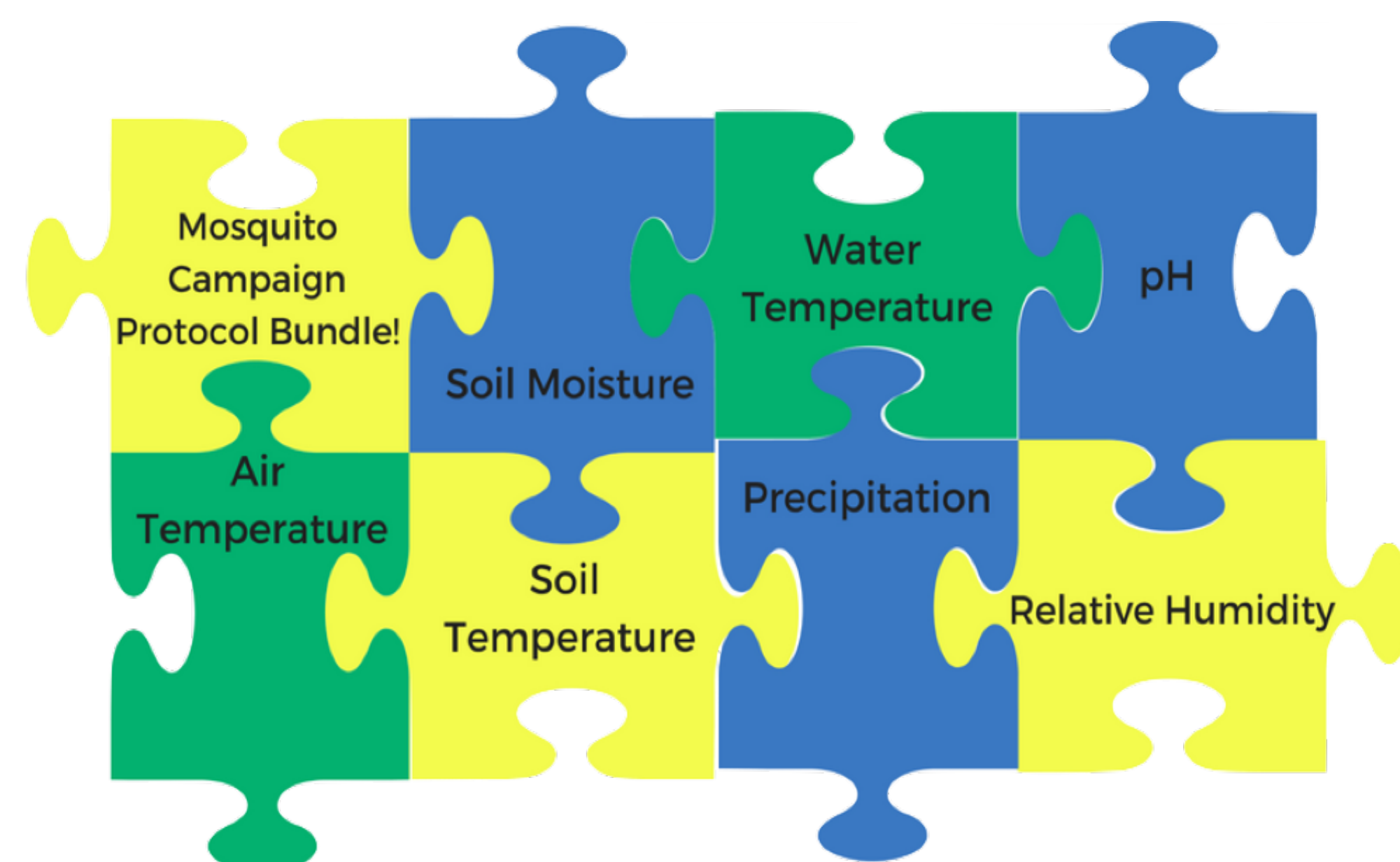


THE GLOBE PROGRAM

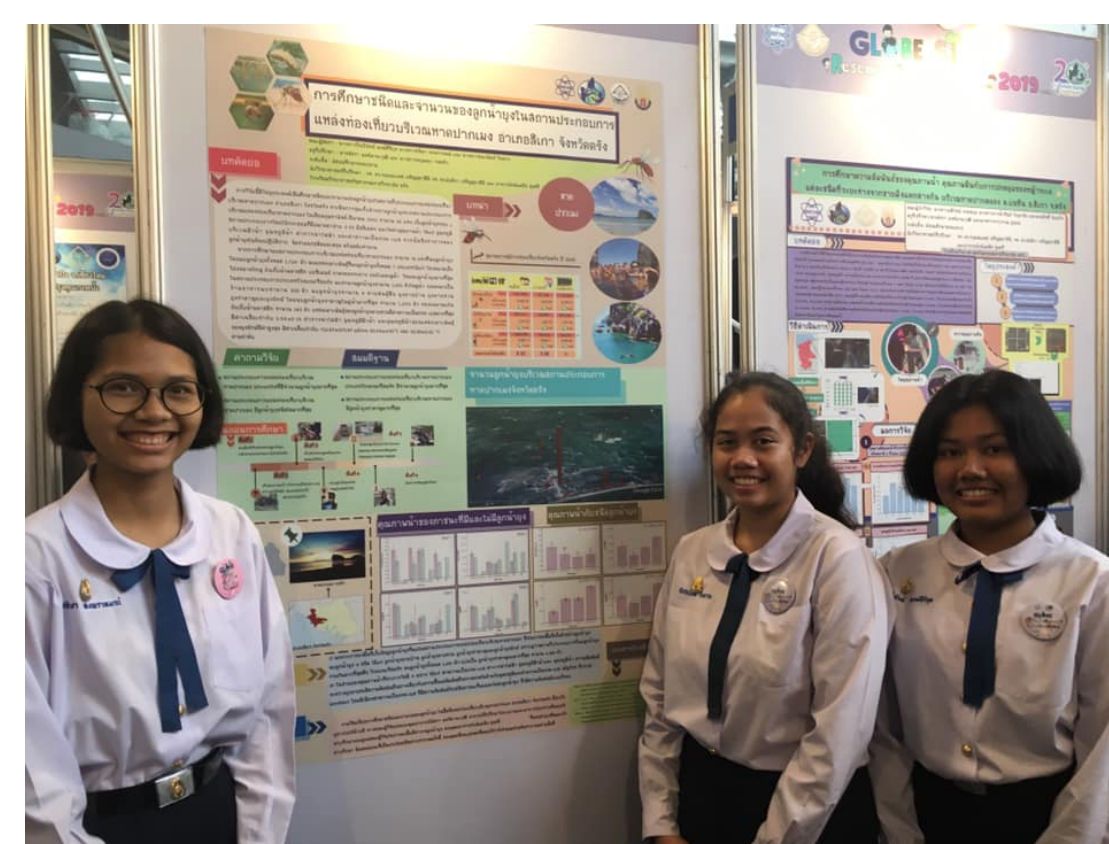
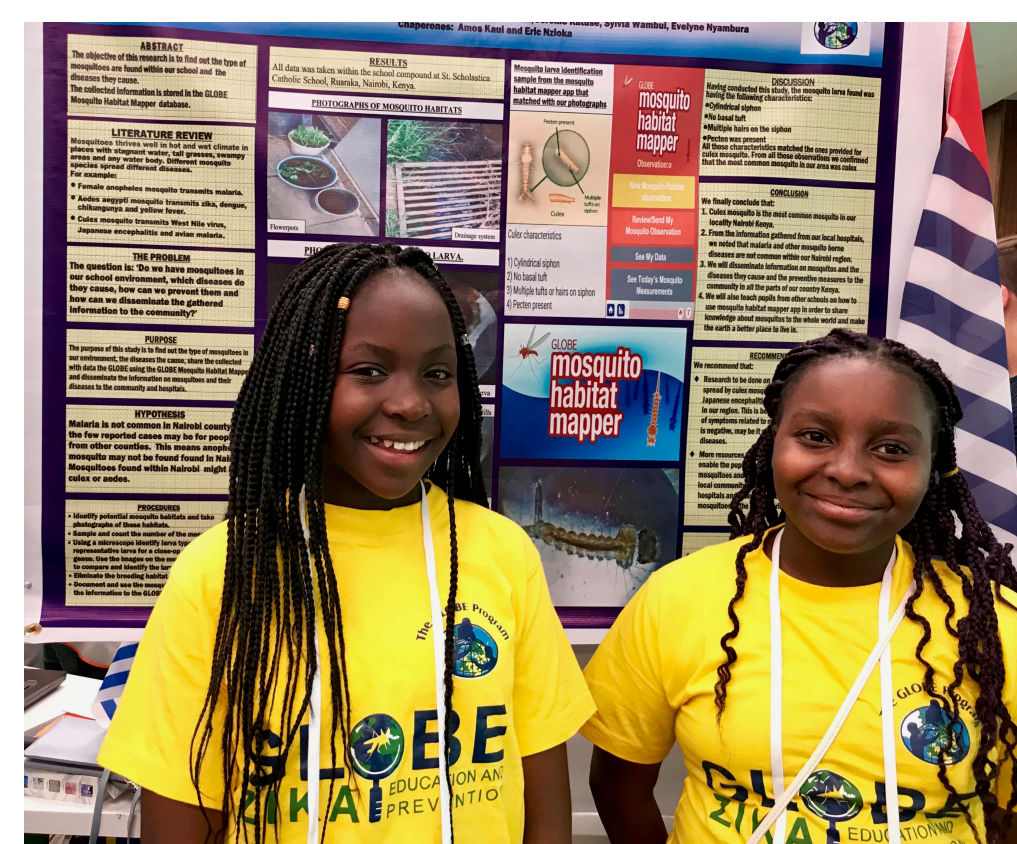


GLOBE Observer

The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection.



Pathogens spread by mosquitos kill more than a million people a year across the world, mostly in tropical regions. Increasing temperature and rainfall are potentially providing suitable conditions and habitats for mosquitos to spread pathogens, however, climate alone is not enough. The mosquito has already hitchhiked to Europe and North America with eggs attached to used tires and lucky bamboo. Movement of people, not shifts in climate is the biggest risk.



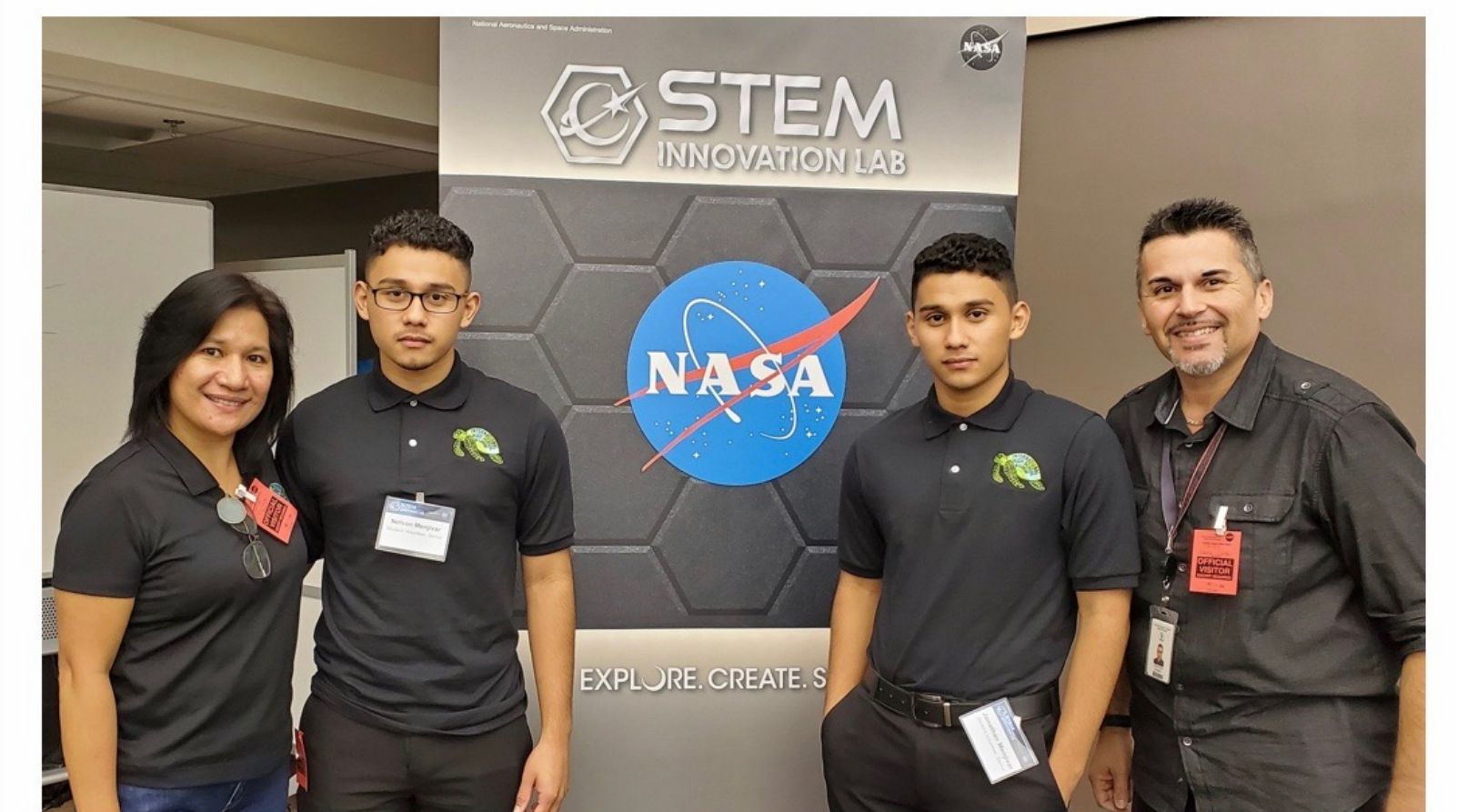
Mission GLOBE Mosquito



This is an authentic research opportunity suitable for citizen scientists and students who are interested in Earth science, environmental science, life science, mathematics, and health. Through webinars and discussion threads you'll be in touch with the GLOBE Mission Mosquito team of scientists and education specialists. You will learn about the health threat that mosquitoes pose both locally and worldwide. By participating in mosquito surveillance, breeding site mitigation, and educational activities, you can play a significant role in reducing the risk of mosquito-caused diseases in your community.

Seniors Receive NASA Spring Internships!

INSIDE PGCPS



STUDENTS PRESENT AT NASA INNOVATION LAB

October 29, 2019

International High School at Largo students and twins Jonathan and Nelson Menjivar recently presented their research at the NASA Innovation Lab!

Image Credit: Inside PGCPS Oct. 29th, 2019 <https://www.pgcps.org/>

Twin high school seniors in Mercy Molina's class showed me their science project- a hologram generator- during one of my visits to the school. I invited them to bring it to NASA/GSFC to show the STEM Innovation Lab team. The team was so impressed that they invited the twins to share it during their STEM Innovation Lab Open House. During the Open House event, the twins interacted with several NASA professionals who assisted them in learning how to apply for a NASA internship for the following Spring. Both boys immediately applied and have been accepted to be interns at NASA/GSFC this spring!

The school will work closely with the STEM Innovation Lab to establish a pilot school "Innovation Hub" at the school.



Choose your protocol:



Visit the Observer Website