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2016

EXPERIENTIAL LEARNING OPPORTUNITIES THROUGH NASA STEM CONTENT ALLOWS GREATER GRASS ROOT-LEVEL UNDERSTANDING OF THE PRESENT DAY'S EXTREME CLIMATE CHANGE SCENARIO

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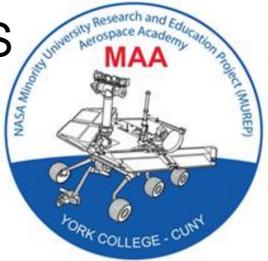
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The NASA MAA (MUREP Aerospace Academy) project at York College has demonstrated a track record of providing experiential learning opportunities (ELO) to its participating students. ELOs associated with MAA are designed to increase learners' involvement, knowledge, comprehension and application of learning in one or more STEM subjects/disciplines. They involve inquiry-and-activity-based learning approaches designed for the level of the learner to inspire, engage, and educate while progressively challenging each student. ELO activities enable learners to acquire knowledge, understand what they have learned, and apply that knowledge through inquiry-based tasks. Specifically, we are prepared to address the following priority: Encourage, increase, and sustain youth and public engagement in STEM—Expand the number of U.S. youth (especially those from traditionally underrepresented groups) who have an effective, authentic STEM experience each year prior to completing high school. Being in southeast Queens, York's program is essentially playing a pivotal role to disseminate STEM resources to minority persons eagerly seeking content knowledge to further their education. Through MUREP, we are committed to advance understanding of the earth and develop technologies to improve the quality of life on our home planet. The introduction of a curriculum enhancement activity (CEA) to the K9-16 students is becoming a new initiative of our MAA project, as well as the formal addition of climate change curricula to the MAA 7-9th grades, and supplying the oversight and resources to accomplish that goal. Numerous studies have shown that providing climate change curriculum to the middle to high school students can allow greater grass root-level understanding of the changing phenomena and scientific constraints associated with such dramatic changes we are now facing. NASA's Science Directorate in conjunction with MAA will enable us to train MAA students and pre-service teachers in this endeavor and bring greater prominence of the MAA STEM contents to the participating students and disseminate real-time data for a realistic overview of the climate change scenario.

NASA MAA STEM Outreach Grant Funded This Project.



MAA: Climate Education Lesson Plan

Learning Objective:

- To assess current knowledge of climate change.
- To define and understand the difference between weather and climate.
- To discuss the importance of climate change education in terms of how climate changes affects the world around us.
- To research various key indicators of climate change.

Class Worksheet: Students are given a pre assessment worksheet^[1] which asks the following questions.

- Which of the following gases is NOT a greenhouse gas?
A) Methane B) Carbon dioxide C) water vapor D) helium.
- How do greenhouse gases affect Earth's climate?
A) Greenhouse gases hold heat in our atmosphere. b. Greenhouse gases destroy ozone. c. Greenhouse gases destroy marble statues. d. Greenhouse gases cause volcanoes to erupt.
- Which of the following is NOT an impact of adding carbon dioxide to the atmosphere?
a. rising atmospheric temperatures b. sea level rise c. more coal available d. ocean acidification
- If global temperatures continue to rise, glaciers will melt at a more rapid pace and their meltwater will cause sea levels to rise.
True/False
- According to scientific data, CO2 levels have reached a level the Earth has not experienced over the past 100,000 years.
True/False
- Name one greenhouse gas and describe how it affects Earth's climate

[1]https://pmm.pps.eosdis.nasa.gov/education/sites/default/files/lesson_plan_files/climate%20change%20online/Climat%20Change%20Online%20Pre-Post%20Assessment.pdf
[2]https://pmm.nasa.gov/education/sites/default/files/lesson_plan_files/climate%20change%20online/Climat%20Change%20Online%20PP.ppt
[3]https://pmm.nasa.gov/education/sites/default/files/lesson_plan_files/climate%20change%20online/Climat%20Change%20Online%20SCS%20v2.pdf

A PowerPoint presentation^[2] leads the class into a discussion.

Class discussion: Students are asked the following question and an open discussion takes place.

What are vital signs?

"Similar to a doctor who checks a patient's vital signs—pulse, heartbeat, temperature, and so on—scientists regularly check Earth's vital signs, which informs us about the health of our planet: global temperature, atmospheric CO2, Arctic sea ice, land ice, and sea level."^[3]

Key Indicators

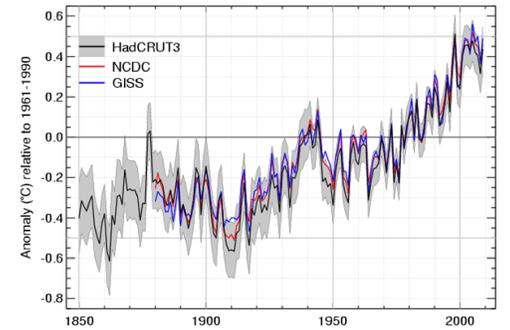
Group research: Students are broken into groups of 4 and choose a key indicator from CO2 concentrations
Global Temperature (surface)
Arctic Sea Ice
Land Ice
Sea Level

After choosing a topic the student capture worksheet^[3] is given to each group and they begin to use the links provided by NASA on the sheet to research and answer questions.

Presentation and discussion: The students present to the class the information they gathered on their key indicator as well as allow other students to ask questions.

Class Worksheet: Students are given a post assessment worksheet, which has the same questions as the pre assessment worksheet.

[1]https://pmm.pps.eosdis.nasa.gov/education/sites/default/files/lesson_plan_files/climate%20change%20online/Climat%20Change%20Online%20Pre-Post%20Assessment.pdf
[2]https://pmm.nasa.gov/education/sites/default/files/lesson_plan_files/climate%20change%20online/Climat%20Change%20Online%20PP.ppt
[3]https://pmm.nasa.gov/education/sites/default/files/lesson_plan_files/climate%20change%20online/Climat%20Change%20Online%20SCS%20v2.pdf



An example of the type of graphs the students made for their data analysis



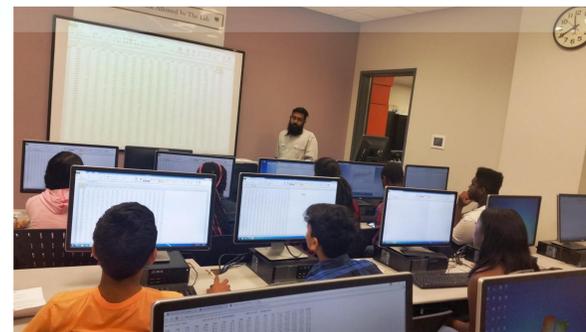
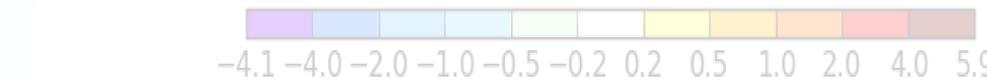
Conclusion

As part of the curriculum enhancement activity (CEA), Climate Change Education (CCE) offered to the younger grades also enabling them to become familiar with basic science concepts and their ultimate constraints related to present days extreme climate scenarios.

Students learn at an early age (10 or above) to retrieve NASA online climate data and run tasks to delineate factors connected with rising air temperature and predict future trends as well.

To make it real, students are given NASA data on New York City's Central Park and it certainly motivates students to engage in CCE exercises and enables them to comprehend the functionality of basic mathematics and meteorology-related concepts in addition to anthropogenic causes of global climate change.

Integration of multidisciplinary STEM subjects coupled with ELO research activities at an early stage can play a pivotal role in motivating K9-16 students to appreciate the broader science contexts and their relevance to geosciences. From recruitment and retention point of view, it should be viewed as being of utmost academic importance.



Students examining climate data from the New York Central Park Station. Instead of reading data off a graph the students will be analyzing the raw data and creating their own graphs.

Each group of students were able to pick a key indicator and given time to research that indicator using the resources provided by NASA run websites.



For many of the students this is their first time looking at climate data, which a majority of students only familiar with the term climate change not knowing the importance and/or the causes of climate change.

Before the lesson began every student was given a Pre-Assessment worksheet to gauge the knowledge of climate change that students new to the MAA program have.

After the lesson the students are then given a Post-Assessment worksheet this aids the instructors in determining how effective the lesson was for the students.