NCAR Careers Diversity Project

(a collaboration with CLACE and Nuestra Tierra Dinamica)

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Key 744222

The Earth Observing Laboratory (EOL), in collaboration with CLACE (Centro Latinoamericano para la Ciencia y Educacion) and its Nuestra Tierra Dinamica program, was awarded support from the NCAR Diversity Fund for a series of project activities designed to engage Latino and other K-12 students, and expose them to atmospheric research and related sciences.

Tapping into EOL field projects and the education and outreach efforts that take place during these field campaigns, academic activities were designed that allowed students from Boulder area high schools to actively participate in these activities (through hands-on science, family nights and CLACE Video Lab tools), to learn about various Earth systems and the scientific research that addresses those systems, and different careers in this field that are available to them. The NCAR Careers Project allowed several students to interact with research scientists while learning basic concepts of atmospheric research through hands-on activities and seminars tailored to their level of education. Some students were able to participate in a field campaign, while others had the opportunity to work as interns at EOL in the summer of 2013. The activities were multidisciplinary and are described below.

**Activity 1: Video Lab**

Video Lab is a student-driven digital storytelling program developed by CLACE for Nuestra Tierra Dinámica (NTD) under NASA Innovations in Climate Education (NICE) funding. The Video Lab was used for the NCAR Careers Project, mainly as a way to develop and support students' natural curiosity about the academic world. The students were first asked about their current academic interest or about issues in climate science (climate change, pollution, etc.). The students were then guided using inquiry-based teaching methodology to answer their own questions and later encouraged to focus on STEM (science, technology, engineering, and mathematics) and digital media education to create relevant and meaningful STEM learning experiences. The Video Lab was an effort that CLACE was already experimenting at Fairview High School in Boulder at the time of this proposal. The student group was very active in creating videos and researching topics of interest to them. After NCAR Careers was approved, Vidal Salazar from EOL became engaged with the student group and provided mentoring support for the participating students. The Video Lab was also used as a gateway for students to visit NCAR as well as several universities.
and national labs located in the Front Range. Photos of the students visiting the NCAR/EOL Research Aviation Facility can be seen here: https://www.eol.ucar.edu/system/files/1-NCAR%20RAF%20Field%20Trip.jpg

At the beginning of the Video Lab activity, the students were shown the film “An Inconvenient Truth.” This film was used to generate discussion about climate change and to familiarize students with the terms and data surrounding climate change. The film was also used as an example of award-winning environmental film making. After this activity, the students started developing their own questions and began forming the storyboard for their own documentaries. The results from this guided activity produced the following short documentaries:

- Loss of biodiversity – Jennifer Aguilera
- Colorado Snow and Climate Change – Darian Valdez
- Climate Change Commentary – Oscar Contreras and Johnny Cortez
- I Have a Carbon Footprint – Vero Castro and Nancy Contreras
- Climate Change in our Community – Itzel Munoz and Gabriel Morales
- On Assignment – Lorena Arellano and Alma Garcia
- Community Perspectives on Climate Change – Diana Briones and Roxana Arellano

The full set of videos is posted here: https://www.eol.ucar.edu/content/clace-trip-agu#VIDEOS

After the students completed their video work, plans were made to take the students to the 2012 American Geophysical Union (AGU) annual meeting in San Francisco, CA. As one of the largest gatherings of scientists of North America, AGU was considered a good venue to expose the Video Lab students to a larger number of diverse researchers working in different STEM fields.

A series of documents were developed as part of planning for this trip. These included invitations for the students as well as letters to the parents on “why we are choosing AGU” and “why we want to take your child to San Francisco” (see: https://www.eol.ucar.edu/content/clace-trip-agu).

Since AGU occurs during the week, the trip had to be designed to allow the students to stay on top of their school work as well as to actively participate in the conference. A series of documents that described the goals of the visit as well as a daily schedule for the students was created. This allowed the group to stay on track with the goals and achievements planned for each day. See: https://www.eol.ucar.edu/content/clace-trip-agu

Students participated in a poster session during the AGU meeting where they were able to interact with experienced scientists and other students. They showed a great deal of knowledge and positive attitude at their poster session, and many of them stayed throughout the afternoon to talk to scientists and answer questions, obviously enjoying the academic
environment and attention. Students were asked to write down their impressions and experiences after each day. Quotes included:

“During my shift, I was very nervous. In the end, however, I really enjoyed the experience”  –Jennifer Aguilera

“Today as we walked down the stairs to breakfast – and we ran into this lady who ended up being the president of AGU!” – Veronica Castro

“Someday, with enough work, I could be presenting my own poster”  – Darian Valdez

The experiences of the group ranged from “very exciting” to “totally scary,” but the overall objective of this visit was to expose the participants to a new academic environment, allow them to see the breadth of science, and most of all, to show them how scientists are passionate about their research.

Photos of the student group visiting San Francisco for the American Geophysical Union annual meeting are here: https://www.eol.ucar.edu/content/clace-trip-agu#PHOTOS

A full set of student impressions throughout the weeklong trip to AGU can be found here: http://www.eol.ucar.edu/homes/vidal/share/FHS_Video_Lab/AGU_Student_Experience/AGU_Student_Experience.html

In addition to attending the AGU meeting, the students were invited to present their videos and talk about their experience with students and faculty at the University of California at Berkeley’s Department of Urban Planning and Engineering. The visit attracted members from the Latin Student Council, the Mexican-Chicano Student Group and the Berkeley Office of Admissions, who all enjoyed the student videos. Also in attendance at the UC-Berkeley meeting was Mr. Ken Alex, the Senior Policy Advisor to the Governor of California’s Office of Planning and Research (OPR). His office runs a “Climate Changers” channel on YouTube that highlights videos from those doing work to advance understanding of climate science and climate change effects. As a result of meeting Mr. Alex, several student videos are now showcased on the OPR site: www.youtube.com/oprclimatechange . A picture of the group session at Berkeley can be found here: https://www.eol.ucar.edu/system/files/IMG_0423.JPG

News articles that resulted from this activity are here:


The students wanted to continue producing videos, so they made a video about their experience at AGU. Please see Video 1 here: https://www.eol.ucar.edu/content/clace-trip-agu#VIDEOS. The summary video 1 captures very well the overall sentiment of the group.
To follow up on their experience at AGU, an event at NCAR was planned that would allow the students to present their videos to the NCAR community and talk to NCAR scientists. This event was widely advertised using posters and Staff Notes, inviting NCAR staff to participate and provide feedback to this group of students. The students were very engaged when sharing their videos to the NCAR community and very much appreciated the NCAR Director taking time from his busy schedule to attend the event. Unfortunately, and in spite of the heavy advertisement of this event through several NCAR-wide communication platforms, the event was poorly attended. Unfortunately there is a general lack of attendance at NCAR events of this nature, which might be due to everybody’s workload, but it is disappointing to see so little interest. The event poster and a photo of the students with then-NCAR Director Roger Wakimoto and then-NCAR Deputy Director Maura Hagan can be found here:  
https://www.eol.ucar.edu/content/talks-and-presentations#NCAR

Evaluation of the Video Lab activity
The CLACE team conducted the evaluation of this activity, which consisted of surveys and direct questions to the students at the different events. Students were asked about their perspectives on the program and on their experiences in attending the AGU meeting.

The students reported to CLACE that throughout the program they learned about a wide range of science concepts, including climate change, greenhouse gases, energy conservation, and loss of biodiversity.

When the students were asked to comment on their experience at the AGU meeting, their comments were consistent and focused around two primary themes: Inspiration and Motivation. There were a number of comments indicating that students were inspired in many ways by the conference:

“...What was more exciting was knowing that mujeres latinas (were) there too showing and representing that anything is possible. That inspired me to keep going with my dreams and not let anything stop me.”
“(I found it exciting) when we got to show our videos to the community.”
“I learned to always follow my dreams. Anyone can be a scientist”

The Video Lab activity was very successful. It provided students that have never contemplated a career in science the opportunity to question why they have not done so, and the opportunity to see a scientific path for themselves through role models. This is especially critical for students such as these who are at risk of not continuing their studies past the high school level.

The full set of documents and photos for this activity can be found here:  
https://www.eol.ucar.edu/content/clace-trip-agu
Activity 2 – Summer Internship

Two summer internship slots were created in the Earth Observing Laboratory to temporarily hire two high school students to participate in a field project and to work directly with field project data. A goal of this internship was for the students to see how scientists address real life problems in the observational science world.

The students that applied for the internships were participants in the Video Lab CLACE experience, and were already exploring topics of climate change. Applicants were mainly interested in how measurements of greenhouse gases are conducted during a field campaign. The selected students each chose a main topic to research during their internship at EOL: Student 1 decided to study Ozone concentrations, while Student 2 decided to learn about Carbon Dioxide emissions.

For the data analysis piece of their internships, data from the HIAPER Pole-to-Pole Observations (HIPPO) field campaign were used, which were an excellent fit due to the multi-year nature of the campaign and because of the worldwide extent of those observations. Using those data sets, the interns were able to successfully create plots that showed the distribution and concentration of their gas of interest in a Google Earth kml file. This showed that the students were able to understand the data sets and able to manipulate them to produce a print quality image of their results.

At the end of their internship term, both students expressed interest in continuing their work through the summer, conducting data analysis and learning more on their topics of interest. However, one of the students decided to enroll in pre-college classes at CU and thus had no time to continue with the internship at EOL. The second student, who continued her internship, participated in the Nitrogen, Oxidants, Mercury and Aerosol Distributions, Sources and Sinks (NOMADSS) field campaign, which took place in Nashville, TN in summer 2013. This campaign provided a great opportunity for in-field experience, and focused on atmospheric measurements that included ozone concentrations in the lower part of the atmosphere. The student traveled to Nashville, TN and participated in the daily activities of the campaign. She also successfully created public announcement videos for the campaign, allowing for her closer interaction with the participating science crew.

This same student also created a poster that was sent to the 2013 AGU meeting and was accepted. Unfortunately, the student was unable to attend the conference due to heavy school work demands which took priority. The poster created was titled “Summary of Global Ozone Measurements Collected from Field Campaigns - A summer Research experience for a pre-college student.” The poster was shown at the AGU 2013 poster session.

The students learned about and explored the following topics to varying degrees during their internship at EOL:
• Field campaign management
• Worldwide distribution of data
• Sensors used for the detection of the different chemicals
• Julian day and how it is used in data sets
• Manipulation of data
• Entering formulas in Excel to manipulate data
• Google Earth and kml files
• HTML
• Info graphics
• Atmospheric parameters (temperature, pressure, winds, etc.)
• Manipulation of data sets
• Other field campaigns

The work carried out during the internships, the poster presented at the AGU meeting, and the two videos created by the student during the visit to the NOMADSS campaign can be found here: [https://www.eol.ucar.edu/content/summer-internship](https://www.eol.ucar.edu/content/summer-internship)

**Evaluation of the activity**
The summer internship was a success. The two students were able to complete a data analysis task that required them to acquire new knowledge and test out techniques that were new to them. The students were exposed to different types of data and data formats, which allowed them to experiment first hand with how the data are collected, analyzed and most importantly interpreted. The field campaign experience was also eye opening, allowing the student who participated to observe field work first hand, something she would otherwise not have seen.

The success of this activity can be seen by the diverse set of documents, images and videos created by the students during their internships.

**Activity 3 – Presentations and invited speakers**

**STEM ON: “Do Cool Things that Matter”**

Jessie Chavez, a software engineer from Google’s Chicago office, was invited to talk to approximately 75 local high school students from Boulder, Niwot and Longmont. The event, titled “Do Cool Things that Matter,” took place on 12 May 2014 at the NCAR Mesa Lab. Jessie is part of a group of Google engineers who actively reach out to minority students to encourage them to enter STEM disciplines and especially computer science. A Chicago native born to immigrant Hispanic parents, Jessie used his talk to dispel the myth of the stereotypical nerdy computer scientist portrayed by Hollywood; compare salaries and job opportunities for computer scientists and professional athletes; and inform students that computer science offers opportunities to solve a wide range of problems from science, medicine and disaster relief to sports, fashion and music. Several NCAR staff stayed after the presentation to talk to
students individually. Photos from the event can be found here: https://www.eol.ucar.edu/content/talks-and-presentations

Family nights
Two family nights events took place at the Boulder Columbine Elementary School. Vidal Salazar from EOL participated in these events, talking to the students about his career path and how he, a native of Mexico, overcame language barriers and became a scientist. The students that attended these family nights were very interested in Vidal’s story and asked many questions.

Marina Lagrave from CLACE was the organizing entity of these activities and thanked Vidal for his participation in an email:

“Dear Vidal,

On behalf of our team, I’d like to extend our sincere appreciation for your attendance at our Family Nights Events at Columbine Elementary. The time you dedicated to this event reinforces our united commitment to education. We know that a critical element for retention of students connecting with STEM and Climate Change education are events like this one, were (sic) scientists like you connect and excite. You played a unique and special role today but mostly; you inspired many future leaders together with its parents and family. Your personal commitment and generosity are truly inspiring. We could not have done it without your support!”

Photos from the family night can be found here: https://www.eol.ucar.edu/content/talks-and-presentations#FAM

Lessons Learned from NCAR Careers
• High school students have a very heavy class load and frequently have extracurricular activities as well; as a result they can have a hard time focusing on non-school work.
• Work given to high school students should be simplified and broken into discrete tasks.
• Tasks need to be adjusted to the student level of understanding of the work.
• Forming connections with high school students can be difficult, and mentors need to be persistent.
• Field trips require advance planning and must include chaperones as well as opportunities for rest or refreshment.
• Activities should be a mix of more sedentary work (such as data processing) and more active work (such as visits to local National Labs), and should strive to create an enjoyable environment.
• When planning for seminars or talks, is important to enlist committed supporters to attend the events.
**Next steps**

- Maintain contact with the high school students that participated in the activities described in this document, and continue to informally mentor them.
- Discuss with the NCAR Diversity Committee and EOL Directorate the possibility of continuing with the efforts made possible by this grant.