

Combining NASA GLOBE Observer with Web Technologies to Broaden High School Student Access to Authentic Science Research Experiences

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Abstract

The emergence of technologies such as mobile devices, web-based analytical tools, social media platforms, open data and cloud computing have the potential to enable broader participation in science research experiences. We discuss how these capabilities were combined with a citizen science app and e-learning modalities to pilot a scalable model to extend the reach of an established high school internship program. STEM Enhancement in Earth Science High School Summer Intern Program is a nationally competitive program. In 2019, more than 600 qualified students applied for 50 positions. Those who were not selected were offered the opportunity to participate in a virtual cohort working with the GLOBE Mission Mosquito science team. Over 100 students elected to take part in the Mosquito Mappers virtual internship. A recently published meta-analysis of European citizen science projects demonstrated that the majority (90%) involved participants in data collection, 42% involved citizen scientists in data analysis, and only 10% of projects provided opportunities for participants to define their own research question (Turrini et al. 2018). A series of 5 research challenges posed during the 10-week program were designed to promote a sense of scientific collaboration amongst the participants and provide a structured research experience. Students identified an original research question, interacted with scientist mentors via live webinars and discussion boards. A virtual science symposium served as the capstone of the internship. The critical threat of mosquito vector borne disease makes student research examining local mosquito populations both relevant and compelling. While vector-borne diseases such as West Nile virus are actively transmitted in parts of the U.S., both a changing climate and the northern migration of invasive mosquito species pose a future threat of diseases such as Zika and dengue. As scientists, students are empowered as agents of change improving health in their community. The Mosquito Mappers virtual internship was created in partnership with NASA, Texas Space Grant Consortium, The University of Texas at Austin Center for Space Research, and the GLOBE Mission Mosquito Program, administered by Goddard Space Flight Center and the Institute for Global Environmental Strategies.

ED11B-0870 Combining NASA GLOBE Observer with Web Technologies to Broaden High School Student Access to Authentic Science Research Experiences

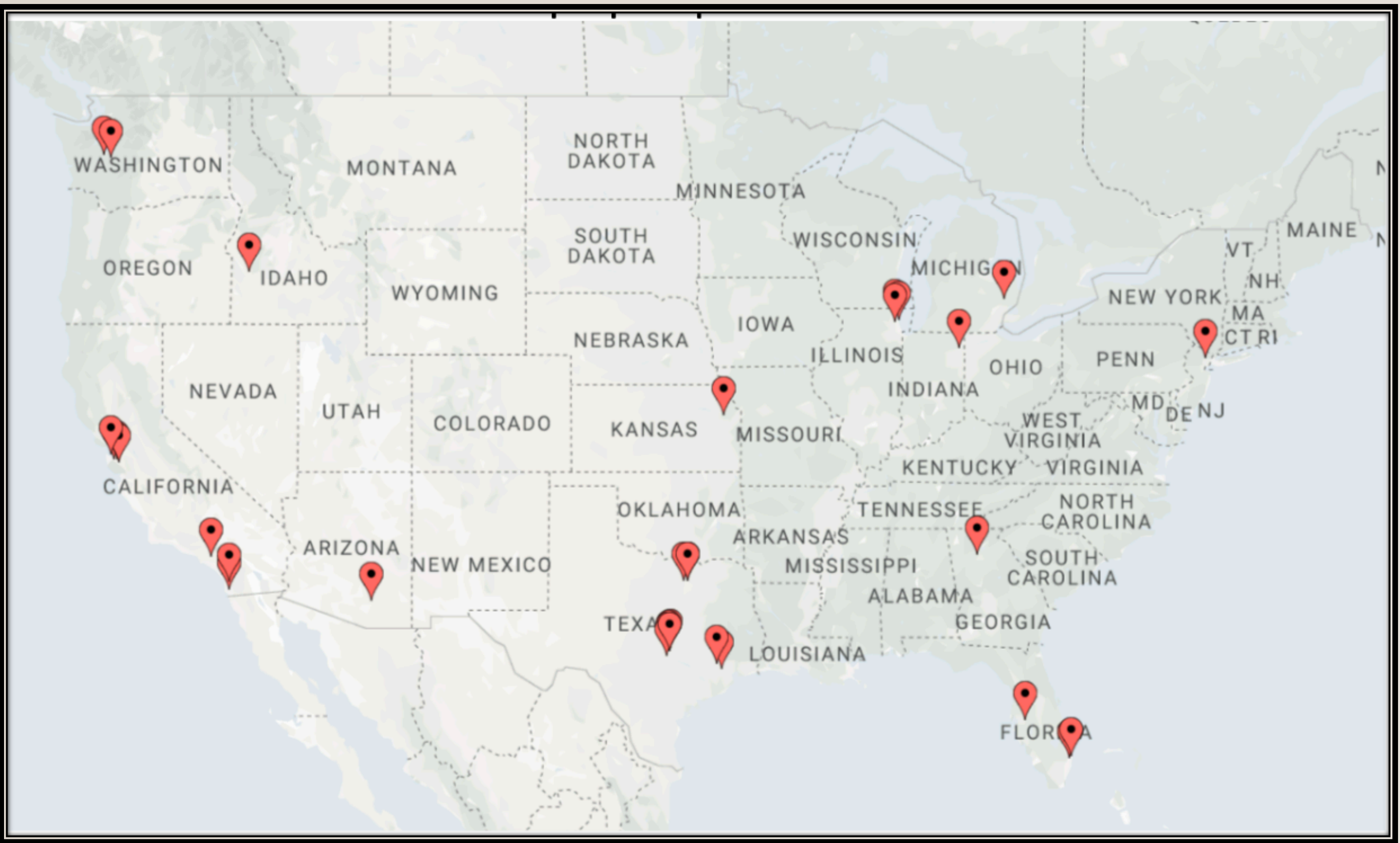
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Summer High School Science Virtual Internship

The STEM Enhancement in Earth Science (SEES) project addresses the national need to increase the number of high school students, particularly under-represented minorities and those from underserved areas, that will pursue STEM college degrees. The SEES project: 1) utilizes NASA facilities and assets to provide authentic work experience, research, and educational opportunities for high school students to encourage STEM careers and preparation; 2) provides opportunities for students and teachers to participate in experiential learning activities that connected learners to NASA-unique resources in Earth Science; and 3) prepares STEM educators and leaders to deliver quality STEM instruction utilizing NASA content.

The “virtual” high school summer internship is a collaboration between two NASA SciAct awards: NESEC and the STEM Enhancement in Earth Science (SEES) by the Texas Space Grant Consortium at the University of Texas, Austin. The SEES project receives many more highly-qualified applications than they can accept for their high school summer internship to work on a NASA Earth science project at the University of Texas-Austin. In 2019, 600 students applied for 50 positions. Students not selected were offered the opportunity to participate in the Mosquito Mappers virtual internship (<http://www.tsgc.utexas.edu/sees-internship/>).



By The Numbers

130 students from 17 states participated (map, above).
>100 hours of fieldwork and analysis per student
69 student research projects eligible for the GLOBE International Virtual Science Symposium
6 guest student scientist blogs uploaded to the GLOBE Mission Mosquito Campaign website

Participants were connected to NESEC team members and each other through an online BaseCamp, participated in webinars with NASA subject matter experts, completed weekly research milestones, and presented their final reports to the NESEC team and fellow interns in a virtual science symposium at the end of the summer.

GLOBE Observer Mosquito Habitat Mapper

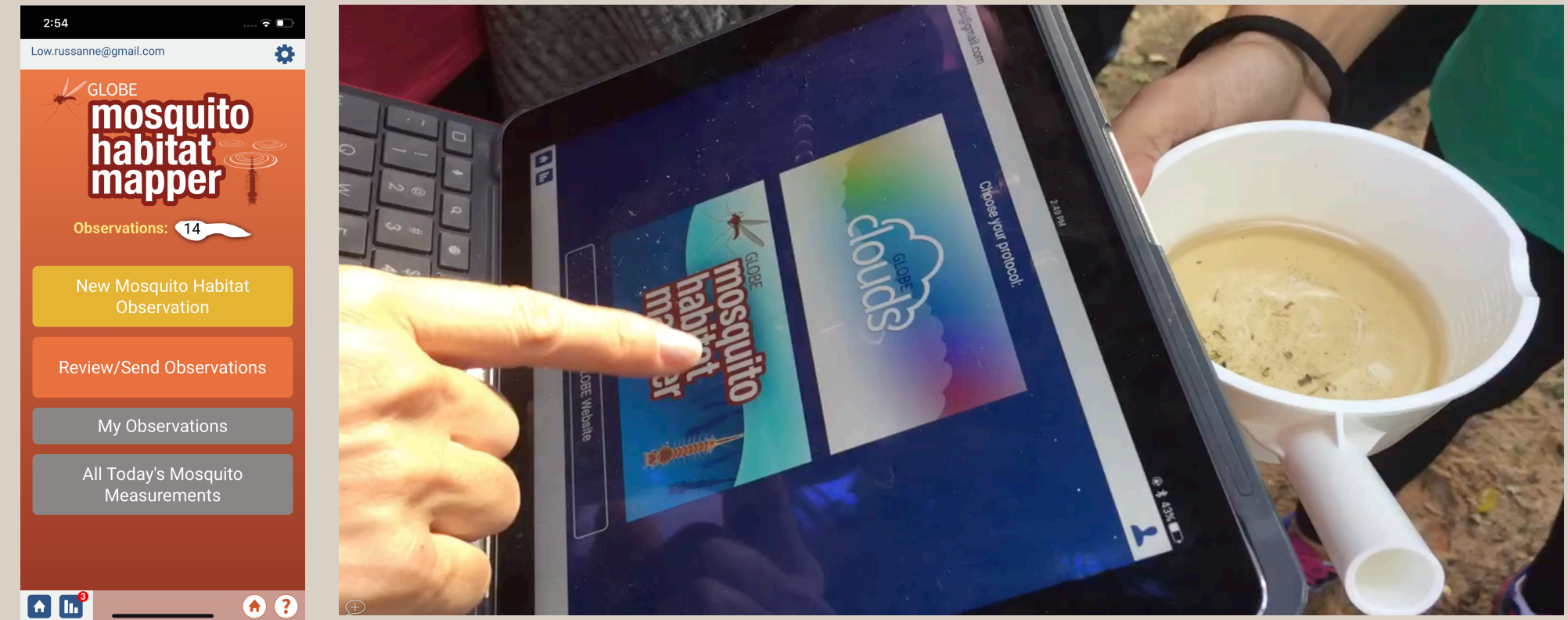
NASA’s GLOBE Observer Mosquito Habitat Mapper (GO MHM) is a mobile citizen science application directed at improving human health in three ways by (1) teaching the user to recognize and mitigate the habitats where mosquitoes preferentially oviposit, (2) providing an interface for users to be part of a global observation network directed at improving understanding of the relationship between mosquito vectors and the habitats they occupy, and (3) tallying each time they remove an oviposition site from use, encouraging vector risk reduction behavior. Beyond contributing to the scientific understanding of the importance of Earth observations to human health, a powerful incentive for participation in GO MHM is how citizen scientists become agents of change, reducing the risk of mosquito-borne disease in their communities. GLOBE Observer is the citizen scientist component of The GLOBE Program (Global Learning and Observations to Benefit the Environment), a science research and education program operating in 122 countries worldwide.



The material contained in this poster is based upon work supported by National Aeronautics and Space Administration (NASA) cooperative agreements NNX16AE28A to the Institute for Global Environmental Strategies (IGES) for the NASA Earth Science Education Collaborative (NESEC) and NNX16AB89A to the University of Texas Austin for the STEM Enhancement in Earth Science (SEES). Any opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of NASA.

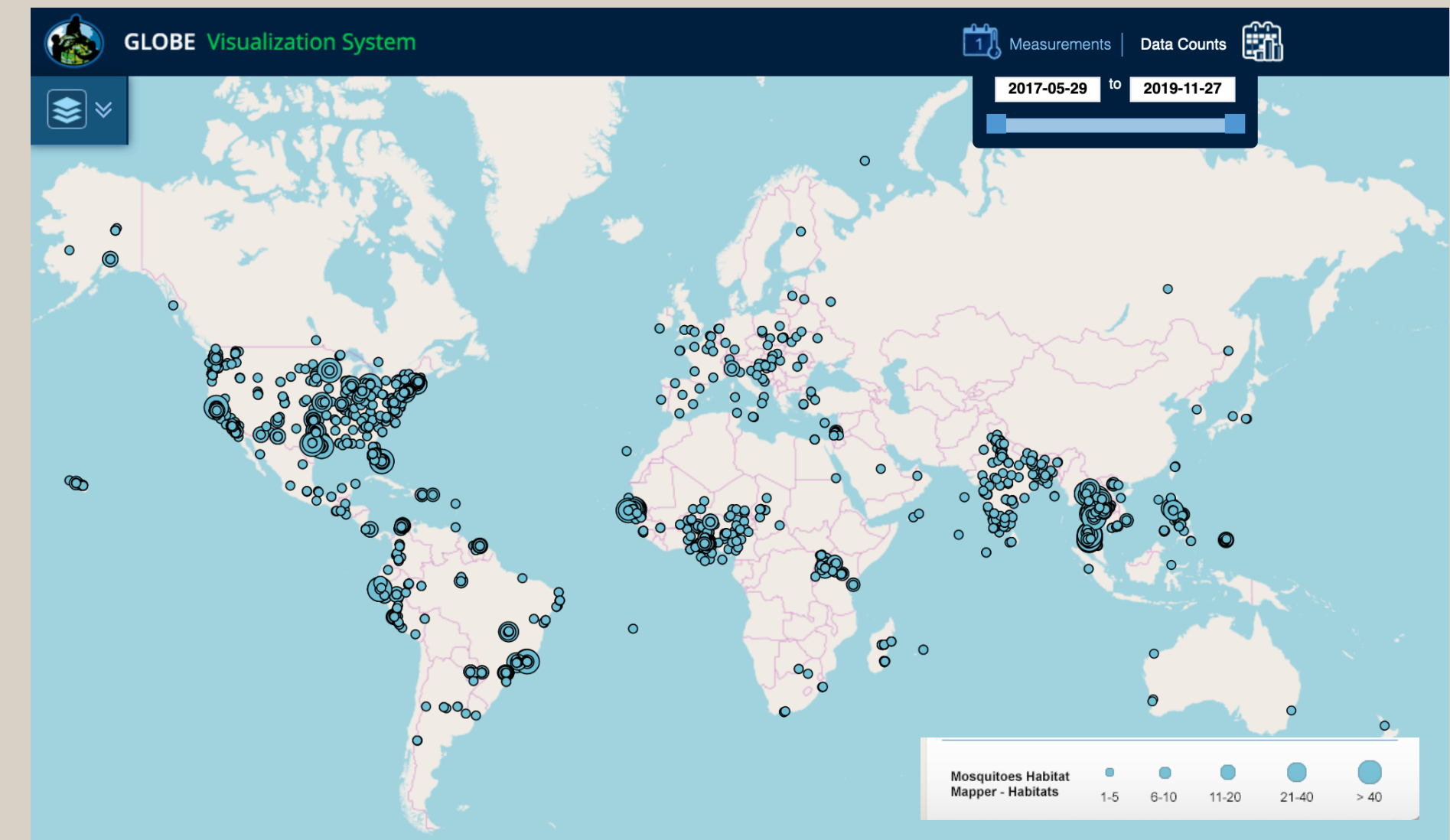
Amazing Technologies and Capabilities in STEAM
enabled data-rich virtual summer science research internships to rising juniors and senior high school students in 2019. 130 students elected to participate in the experience, 103 completed the internship and 69 submitted final research projects to a virtual science fair at the end of the summer.

GLOBE Observer Mobile App



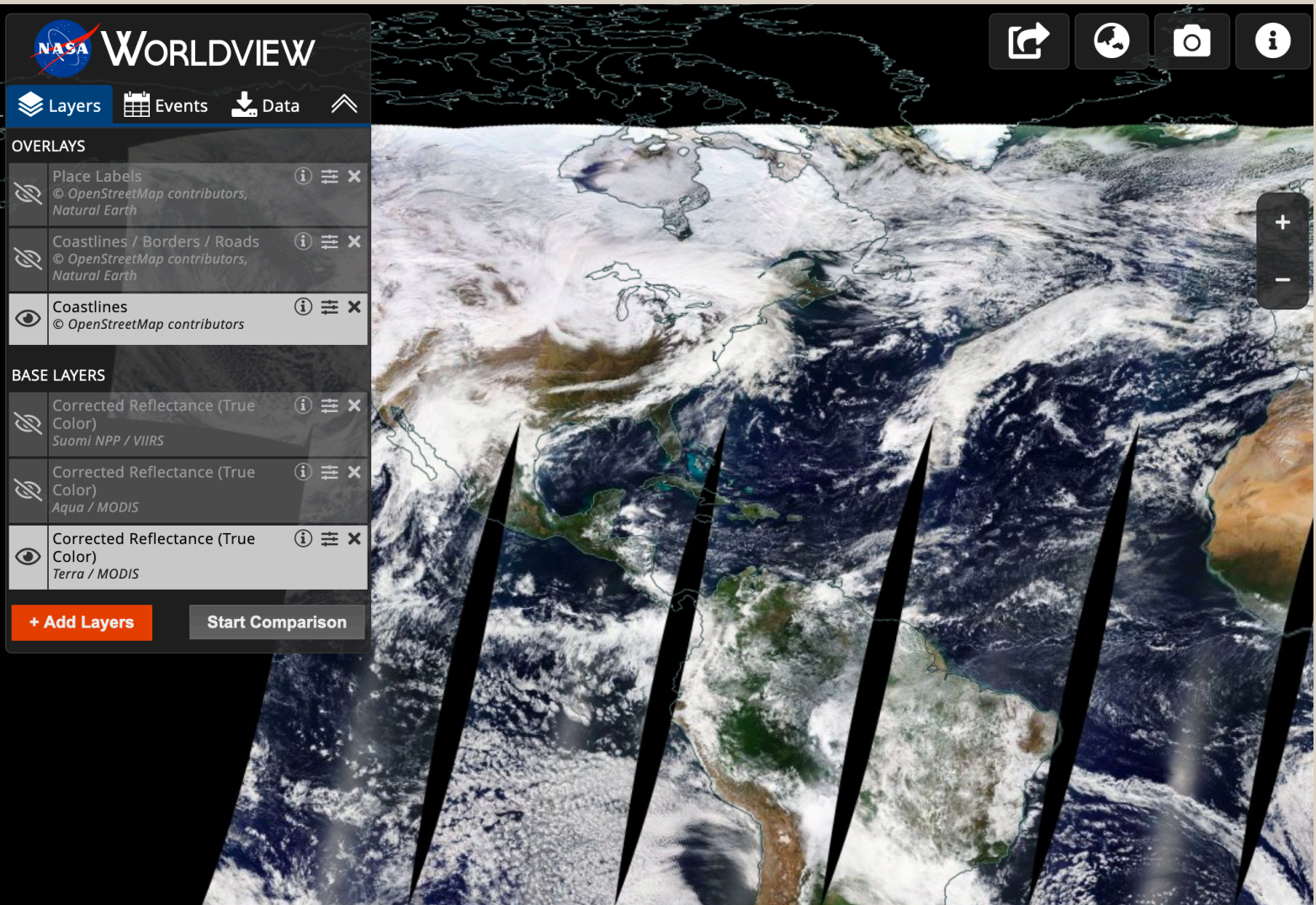
Enabled data collection by the distributed science team

GLOBE Visualization System



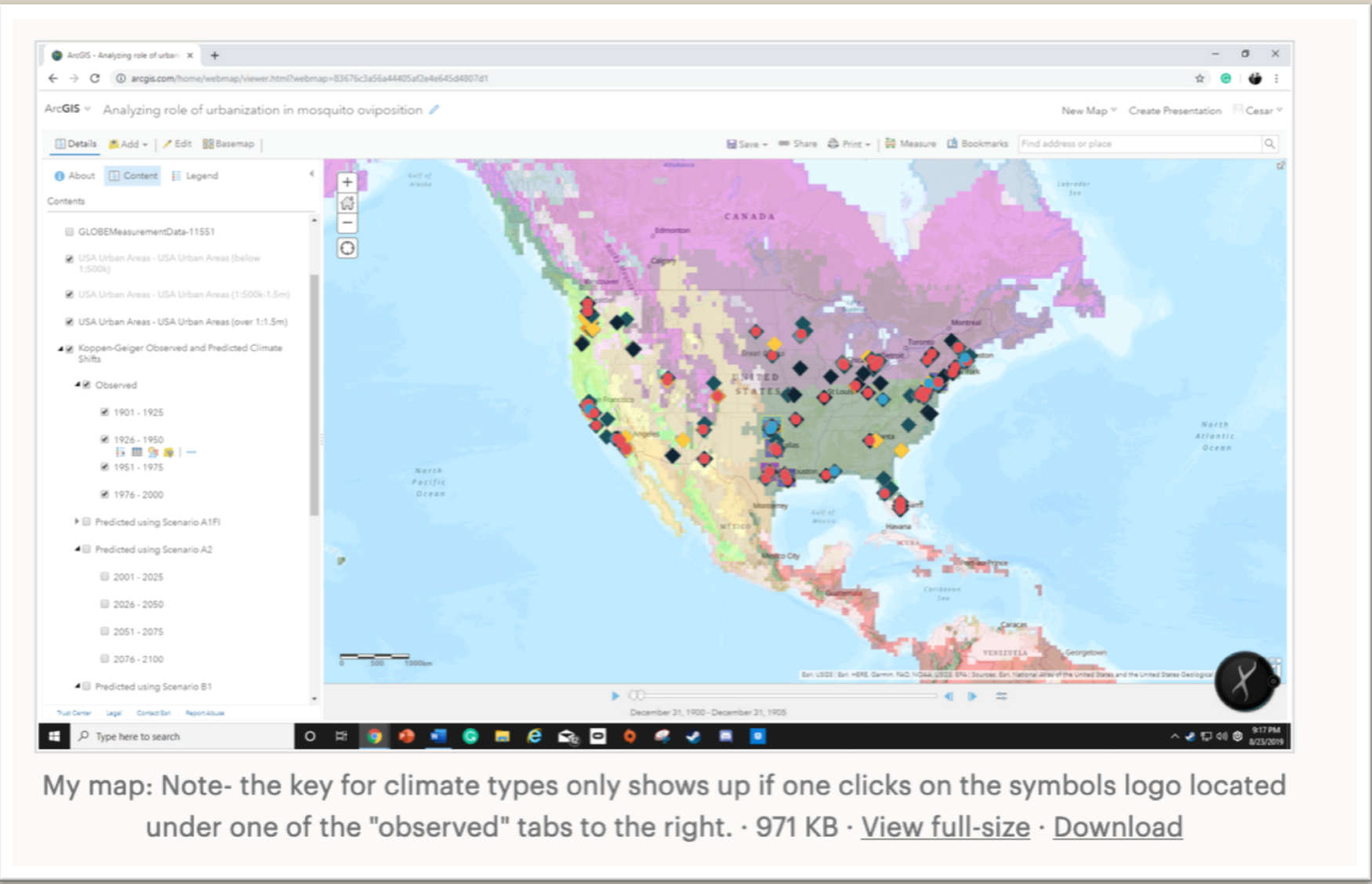
Team data uploaded to the GLOBE database

NASA Worldview



NASA’s EOSDIS provided the capability to interactively browse over 900 global, full-resolution satellite imagery layers and then download the underlying data

ArcGIS Online



ArcGIS Online enabled map-based data analysis



Guest Scientist Blog: Mosquito Larvae Hide and Seek in a Chapparral Ecosystem

By Russanne Low | 997 Views, 8 Comments



2019 Mosquito Mapper Intern: Photo of T. in the field, observing

Before this project, I never ever imagined I would be interested in fish-eating nematodes. However, the more I realized how interesting my own life, the more I saw their importance.

My field experience was designed to figure out what vegetation a California has recently emerged from a multi- typically scarce (often travel miles by car to be

In addition to conserving water, San Diego Cal

Landscape is regularly sprayed roughly every 10

number of mosquito bites.

Initially, the one place I have found mosquito

coyotes, rattlesnakes, and poison oak, but also

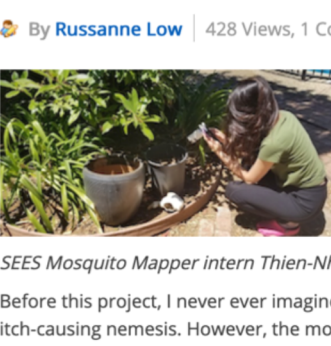
At this point I need to leave the trail, so a hike

Because the water was out of my reach, I need

to pick up water with mosquito larvae.

Guest Scientist Blog: The Frustrations of Fieldwork and the Rewards of Collaborative Science

By Russanne Low | 428 Views, 1 Comment



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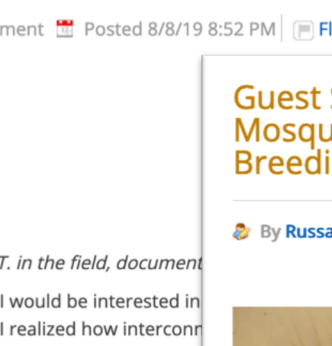
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Guest Scientist Blog: The "Cannibal Mosquito": Carnivorous Mosquito Larvae Reduce Numbers of its Prey in Container Breeding Habitats

By Russanne Low | 303 Views, 1 Comment



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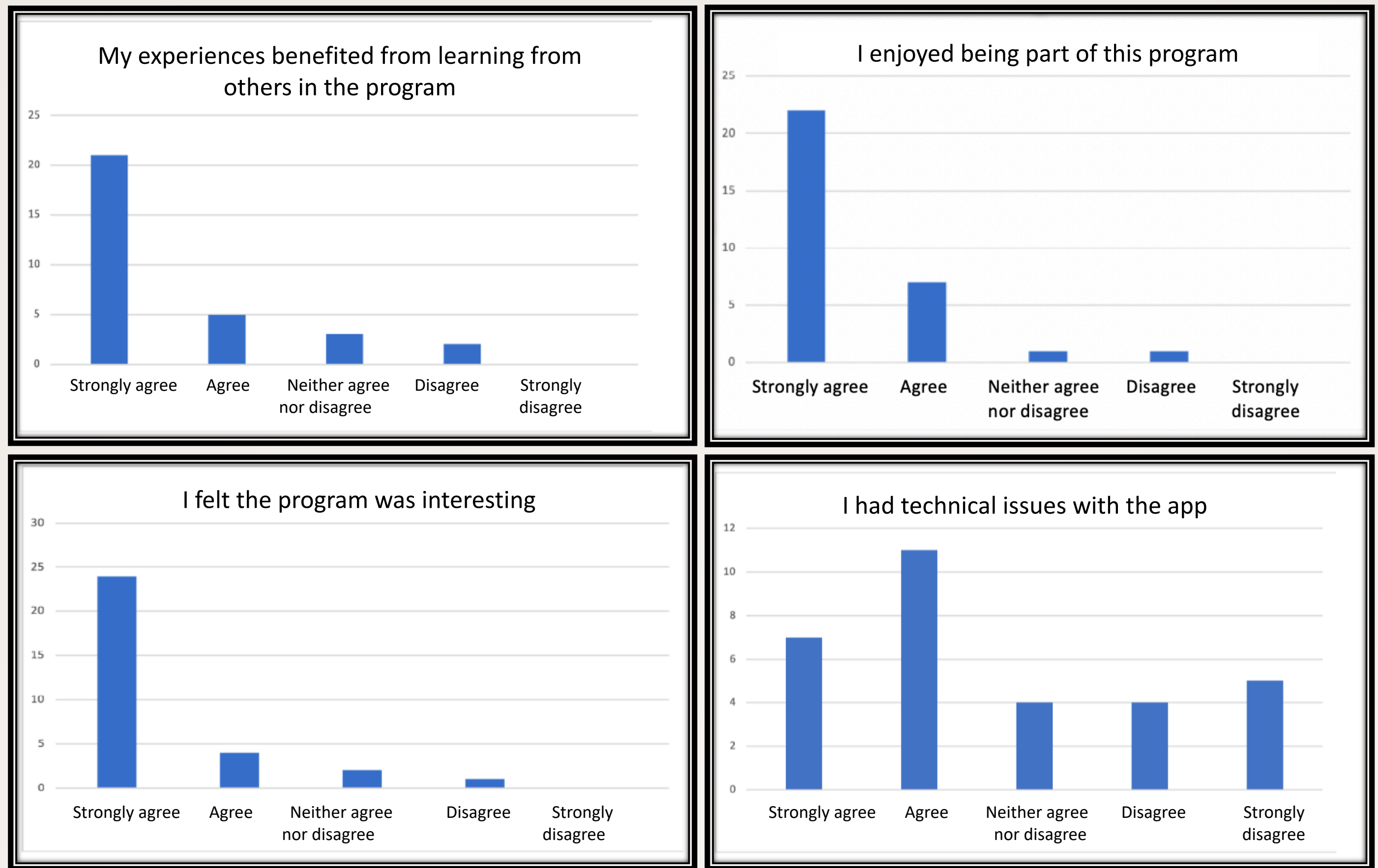
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Pilot Outcomes

Holly Cho, Center for Research on Lifelong STEM Learning, Oregon State, administered a survey at the end of the internship to determine student satisfaction with the virtual internship format. Respondents (n=33) indicated that the online tools were effective at helping them improve their experiments and a majority reported that they always used advice or “lessons learned” from others to improve their work. Most respondents indicated that they benefited from learning from other students in the program. Technical issues with the app were identified by users, and several made suggestions how to improve the app in the next version.



NASA and other agencies play an essential role in the education and communication to inspire, engage and educate. The remarkable science discoveries, knowledge, and research are shared with audiences through a variety of technologies such as web portals, mobile apps, and citizen science/crowdsourcing applications. This contributes to improving teaching and learning, increasing scientific literacy of the general public, and enriching STEM efforts.

These technologies contribute directly to promoting scientific equity by making data-rich science research experiences accessible to students who work in the summer or are unable to participate in a residential internship. All resources employed in this pilot are no-cost and available through either an app store or web portal.

GLOBE Observer: <https://observer.globe.gov>
GLOBE Mission Mosquito Campaign: <https://www.globe.gov/web/mission-mosquito>
GLOBE database and Visualization System: <https://www.globe.gov/globe-data>
NASA Worldview: <https://worldview.earthdata.nasa.gov/>
ArcGIS Online: <https://www.arcgis.com/index.html>

