Insights Evaluation LLC

U.S. GLOBE 2021 Evaluation Brief

Prepared for:
Jennifer Bourgeault, MA
GLOBE U.S. Country Coordinator

Prepared by:
Eleanor M. Jaffee, PhD
Owner & Principal Consultant
Insights Evaluation LLC

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Introduction

Global Learning and Observations to Benefit the Environment (GLOBE) offers an array of resources to support youth engagement in scientific research in the U.S. and worldwide, including learning activities, research protocols, data sharing, mentorship, teacher professional development, and expert consultation. Eighty-nine U.S. student research projects were uploaded to the GLOBE website during the 2020-21 academic year (AY). The U.S. GLOBE Program is housed at the Joan and James Leitzel Center for Mathematics, Science, and Engineering Education at the University of New Hampshire (UNH). A cornerstone of the U.S. GLOBE program is the Student Research Symposia (SRS) held annually in six regions across the country and coordinated by the U.S. GLOBE Program Office. Since 2016, the GLOBE SRS have given students and educators an opportunity to share the results of their GLOBE scientific research projects, get feedback from knowledgeable reviewers, engage in peer review, and participate in experiential learning activities. A total of 894 students and 240 educators have attended.[1]

The 2020 and 2021 SRS were canceled due to the COVID-19 pandemic. Therefore, program and evaluation activities shifted focus to the mentorship provided by U.S. members of the GLOBE International STEM Network (GISN) North America region. This brief describes the evaluation activities conducted in the 2021 fiscal year (FY) and reports the results of a survey of the U.S. GISN members. These activities were supported by the National Aeronautics and Space Administration (NASA, Grant No. 80NSSC18K0135) and Youth Learning as Citizen Environmental Scientists (YLACES).

Evaluation Activities FY 2021

GLOBE mentoring activities take place throughout the school year to support facilitation of science learning, with the particular objective of reaching students in schools serving high proportions of underrepresented minority (URM) students and students from low-income communities. STEM professionals from the GISN offer experiential science learning opportunities, share their experiences in STEM fields, and support GLOBE student research projects. The U.S. GLOBE program is increasing its efforts to provide demographically aware representations of STEM professionals so that URM students can better envision themselves as future scientists. Some students in mentored classrooms and programs also attend the SRS each year (when it is held).

In the past FY, we designed a pilot evaluation project to learn more about mentorship processes and outcomes. We also obtained UNH Institutional Review Board (IRB) approval to use the evaluation data for research purposes and publicly disseminate the research findings. In the future, we may seek to bridge this new component with SRS evaluation activities to investigate how mentorship influences students' science interest and self-efficacy and how this relates to SRS outcomes for those who attend. Pilot participants will include educators registering for classroom and program mentorship (whether or not they attend an SRS) and GISN U.S. STEM professionals who volunteer for the mentoring program. The pilot required development of a suite of new survey questionnaires and other data collections:

1. A Qualtrics (online) GISN U.S. member survey to update and supplement the information already available in the GISN member database, including position, scientific focus, mentoring activity preferences, demographics, and social identities and lived experiences. The intention of this data collection is to improve the matching of mentors with classrooms and programs. The

[1] Count is non-unique; includes multiple records for students and educators who attended in multiple years.

survey was administered via Qualtrics direct emails to all GISN U.S. members and was promoted as an opportunity to participate in mentorship activities for their annual GLOBE service.

2. A Qualtrics registration survey for educators seeking to be matched with GISN U.S. STEM professionals to collect information about grades and subjects taught, learner populations, educator demographics, and expectations of the mentoring program. The registration survey link is posted on a Wakelet online bulletin board established for the mentoring program; distributed via GLOBE's educator communication channels, such as newsletters, email blasts, blog posts, and Facebook; and may also be sent via Qualtrics direct emails.

3. Records pulled from the You Can Book Me scheduling tool educators will use to schedule (for now virtual) activities with STEM professionals. Information collected will include the educator and STEM professional engaging in the activity, the class grade and subject, dates/times activities have taken place, and topics covered. If educators and STEM professionals do not reliably use this scheduling system, we may attempt to gather this information in other ways with participant permission, for example, via direct email communications or records requests.

4. Brief Qualtrics post-activity surveys of educators and STEM professionals to report on their first engagement experience together and any subsequent experience for which they would like to submit feedback. At the end of an activity, You Can Book Me will automatically send out a thank you message to the teacher and the STEM professional with a Qualtrics survey link. We may also post the survey link and/or send it out via Qualtrics or GLOBE communications.

5. An end of AY Qualtrics survey administered to educators and STEM professionals to reflect on the overall mentoring program experience, perceived impact on students' interest in STEM, and areas for program improvement.

Additionally, we created new STEM professional and educator information and consent forms for participation in research. Please follow the hyperlinks to view the materials via the GLOBE website. Data from the pilot evaluation will be analyzed to determine participant demographics, how the mentoring program is being operationalized (e.g. how frequently STEM professionals meet with students, how many students participate, what kinds of activities occur, and what topics are covered), how satisfied participants are with the program, the perceived impact of the program on students, and the relationships among operationalization, satisfaction, and perceived impact (e.g. does perceived impact or satisfaction vary with types of activities, frequency of activities, or demographic representation). Understanding more about GLOBE mentoring can help to identify its benefits and inform improvements to better support STEM learning and scientist representation, particularly among URM students.

To date, only the U.S. GISN member survey has been fully administered. Aggregate survey results are reported in the next section. The survey data will also be entered into a database to use for mentor matching. The remainder of the data collections are now slated for the 2021-22 AY. In the 2020-21 AY, U.S. GLOBE program staff observed that teachers were often too overwhelmed with their efforts to provide remote and hybrid education during the pandemic to consider additional activities.

U.S. GISN Member Survey Results

The GISN U.S. member survey was distributed in Spring 2021 via Qualtrics to all 80 active U.S. members, including six new members who joined the GISN while the survey was in progress. Thirty-seven members completed the survey for a response rate of 46%. In the initial distribution, 12 member emails bounced (did not reach recipient inboxes due to address error, capacity limit, firewall, etc.). Updated email addresses were located for two of these members and used in subsequent distributions. As the survey was promoted as a way to get involved in mentorship activities and fulfill GLOBE service requirements, the remainder who did not participate may not have been interested in or available for mentoring at the time, may not have received the survey, or simply chose not to take it.[2]

According to internal GISN North America member data, six of 17 invitees currently with NASA organizations completed the survey. More than half of all the survey participants (56%) were members from the Northeast/Mid-Atlantic U.S. GLOBE region. This proportion was followed at a distance by the Northwest and Pacific regions (11%) , the Midwest (8%), and the Southwest (6%). (See Table 1 below for regional participation numbers and rates.[3,4]) There was no region indicated for 8%. No participants were from the Southeast region. The maps in Figures 1 and 2 (right) display the states of all 80 active GISN U.S. members and the states of the 37 survey participants, respectively.[5] Darker shading indicates a greater number of members or participants. Eighteen survey participants (49%) consented to participate in the research, two declined, and the rest did not respond.

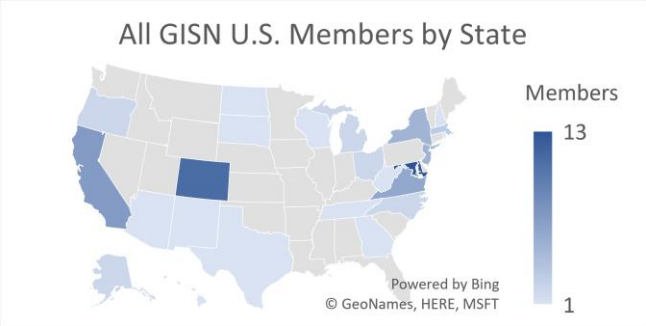

Figure 1. Map of GISN U.S. members by state from member database.

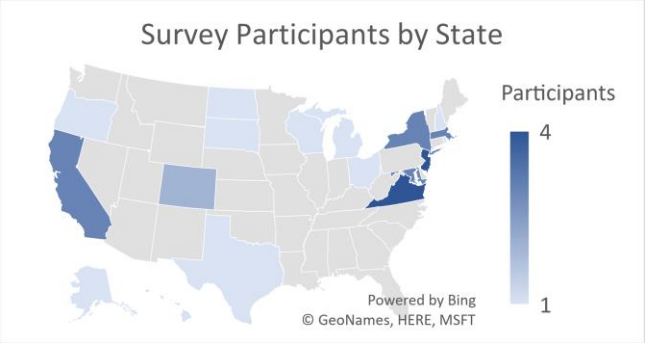

Figure 2. Map of survey participants by state from member database.

Table 1. GISN U.S. membership and survey participation by state.

Region	All Members	Survey Participants	Regional Response Rate
Midwest	5	3	60%
Northeast/Mid-Atlantic	36	20	56%
Northwest	6	4	67%
Pacific	8	4	50%
Southeast	4	0	0%
Southwest	9	2	22%
TOTAL[4]	**80**	**37**	**46%**

[2] One participant took the survey but indicated in the comments they were not currently available for mentoring.
[3] Not displayed in table: only GIO listed as region (5) and region missing (7).
[4] Please visit the GLOBE website to view the states within each GLOBE region.
[5] State data missing for seven members, three of whom were survey participants.

Demographics

Asked to select their current educational or professional position(s), the 37 survey participants made 41 selections, indicating that several held multiple positions. Thirteen reported their position as professional or industry scientist, 11 as professor, and 17 as others including graduate students and postdocs, instructors and educators, and program administrators. Survey participant gender was approximately evenly distributed across male (51%) and female (49%).

Participants were requested to indicate their race and ethnicity, selecting all that apply, yielding 38 selections and one response (3%) of 'I prefer not to answer.' The majority (62%) selected White, and 13% selected Asian. The remainder (23%) selected Black or African American; Hispanic, Latino, or Spanish origin; or other race, ethnicity, or origin.[6] (Figure 3.) No participants described their home organizations as a Historically Black College or University (HBCU), Hispanic Serving Institution (HSI), or Tribal College or University (TCU). One described their home organization as another type of Minority Serving Institution (MSI).

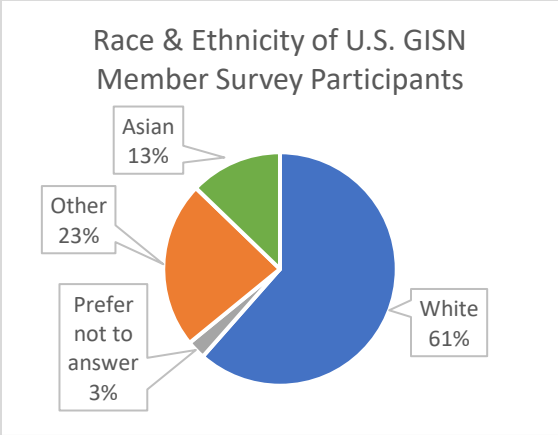

Figure 1. Participant race and ethnicity (n=37).

Participants reported fluency in more than 10 languages other than English, including Spanish, French, and Hindi. Nine reported that English was not their first language, and eight reported that they were immigrants from countries outside the U.S. Five participants reported that they were in the first generation of their family to attend college. Others reported among their social identities and lived experiences being LGBTQA+, non-cisgendered, or non-binary; living with a disability or identifying as a disabled person; and qualifying for free or reduced lunch at some point in K-12 school.

GLOBE Mentoring Focus and Preferences

Participants were asked to identify their GLOBE spheres, selecting as many as apply, and their specializations within the selected spheres. About 20% of participants selected one GLOBE sphere and the remainder selected two or more spheres, for a total of 96 selections. Atmosphere had the greatest number of selections with 28, and pedosphere the lowest at 14. Thirteen selected 'other.' (Table 2.)

Asked which types of mentee groups interested them the most, with the option to select as many as apply, participants most frequently expressed interest in mentoring smaller groups of students such as GLOBE project teams (27), school classrooms (25), and in-school science programs or clubs (24). Somewhat fewer selected out-of-school science programs or clubs (19), and the fewest selected homeschooling groups (11). Seven selected 'other.' Regarding grade band of mentees, participants most frequently selected that they were prepared to mentor students at the high school level (32), followed by middle school (27), upper elementary (17), and lower elementary (6).

[6] Demographic categories with fewer than five selections are aggregated to protect participant privacy.

Table 2. Participant GLOBE spheres and specializations (n=37).

SPHERE	Specializations
ATMOSPHERE (28)	Air quality; air quality remote sensing; air quality studies; air temp, clouds, precipitation, surface temp, soil temp; boundary layer or climate; chemistry; climate change; climate science; climate, climate change; clouds; clouds, temperature, precipitation; clouds; atmospheric physics; meteorology; nuclear security; remote sensing; surface temperature; weather, climate, and air quality; weather/climate
BIOSPHERE (21)	Ecology, marine life, coastal environments; ecosystems; land cover; land cover, biometry, tree height, carbon cycle; land cover/use, biometry, tree and ground cover; land cover; nuclear physics; phenology, carbon cycle; plant phenology, tree height; tree studies; wetlands
HYDROSPHERE (20)	Land surface hydrology; macroinvertebrate study; monitoring all hydrologic variables, and remote sensing; mosquitoes; ocean; oceanography; snow, precipitation, snowpack; surface water temp, pH, electrical conductivity, dissolved oxygen, transparency; temperature, transparency; water quality
PEDOSPHERE (14)	Agriculture; sedimentary geology; soil (soil temp); soil composition studies; soil frost; soil moisture; soil temp, soil moisture, soil characterization, bulk density, frost tube
OTHER (13)	AI for educators, global competencies, intercultural communication, teamwork and leadership skills; citizen science sensor; cybersecurity; earth systems; extreme events and climate resiliency; geospatial analysis; earth system science; mechanical engineering, acoustics; oceanography; remote sensing analysis, GIS analysis; science communication; soil microbiology; urbanization, land cover change, GLOBE Observer

The greatest number of participants were interested in supporting GLOBE research projects as a GLOBE mentoring activity (32). The remainder of the activities were selected by similar numbers of participants: discussing their STEM profession or career (25), discussing their substantive area(s) of scientific research, discussing STEM career pathways (20), and facilitating science learning activities with students (20). In terms of the type of mentoring engagement, single talks or activities was selected most (24), with series of several talks or activities and full academic year partnerships both following (16 for each). Six selected 'other' and specified particular projects or relationships, including one explaining that they are "interested in including full AY partnerships in NSF or NASA grants as outreach/education partners to ensure I am compensated for my time commitment."

The most frequently selected format for engagements was virtual, synchronous (28), followed by In person, in the classroom or program site (23); in person, out in the field (18); virtual, asynchronous (17); in person, at place of work or organization (10), and other (2). In person activities were specified as 'when safe to resume' given pandemic-related barriers to pursuing such activities safely at this time.

Figure 4 on Page 8 visually summarizes these mentorship preferences.

Most participants (35) reported that they had previously done talks, presentations, or mentoring on science topics with K-12 students; the majority (23) reported they had done so more than 10 times. Twenty-nine of the 37 participants reported formal or informal training in science communication.

Discussion & Recommendations

Although it was not possible to implement our full pilot evaluation of GLOBE U.S. mentoring activities in AY 2020-21 due to the COVID-19 pandemic and the related strains on educators engaged with GLOBE, we accomplished all of the relevant evaluation planning and design activities. This puts us in an advantageous position to launch the full pilot in the 2021-22 AY. It is not yet known if the SRS will be held in Spring of 2022 and therefore whether the associated evaluation activities will be implemented.

The results of the GISN U.S. member survey show the participants as a group to be well-rounded in terms of their scientific focuses within the different GLOBE spheres, as well as their selected types of mentee groups and the types and formats of mentorship engagements, although the pandemic continues to be a barrier to in person engagements. Fewer participants felt prepared to engage with the lower elementary grade band than with older students; this may or may not be an issue depending on program priorities and the grade bands of the educators who choose to engage in mentoring activities. If it does become an issue, it could potentially be remedied with mentor trainings and experiences.

The participants were evenly distributed by gender. However, the range of racial and ethnic representation of participants was somewhat limited. Additionally, no participants were from the GLOBE Southeast region. On the programmatic level, this may translate to challenges matching majority URM student classrooms and groups with GLOBE mentors who can broaden their representation of who can be a scientist and help them to picture themselves as future science professionals. Further outreach is recommended, particularly with MSIs and particularly those in the Southeast region. While such initiatives are underway, GLOBE may consider offering technical support to mentors in high demand for representation with URM students to create “packaged” asynchronous virtual mentoring activities that could be shared widely, reducing the burden of synchronous student activities, and preventing undue levels of responsibility and effort for underrepresented GISN U.S. members.

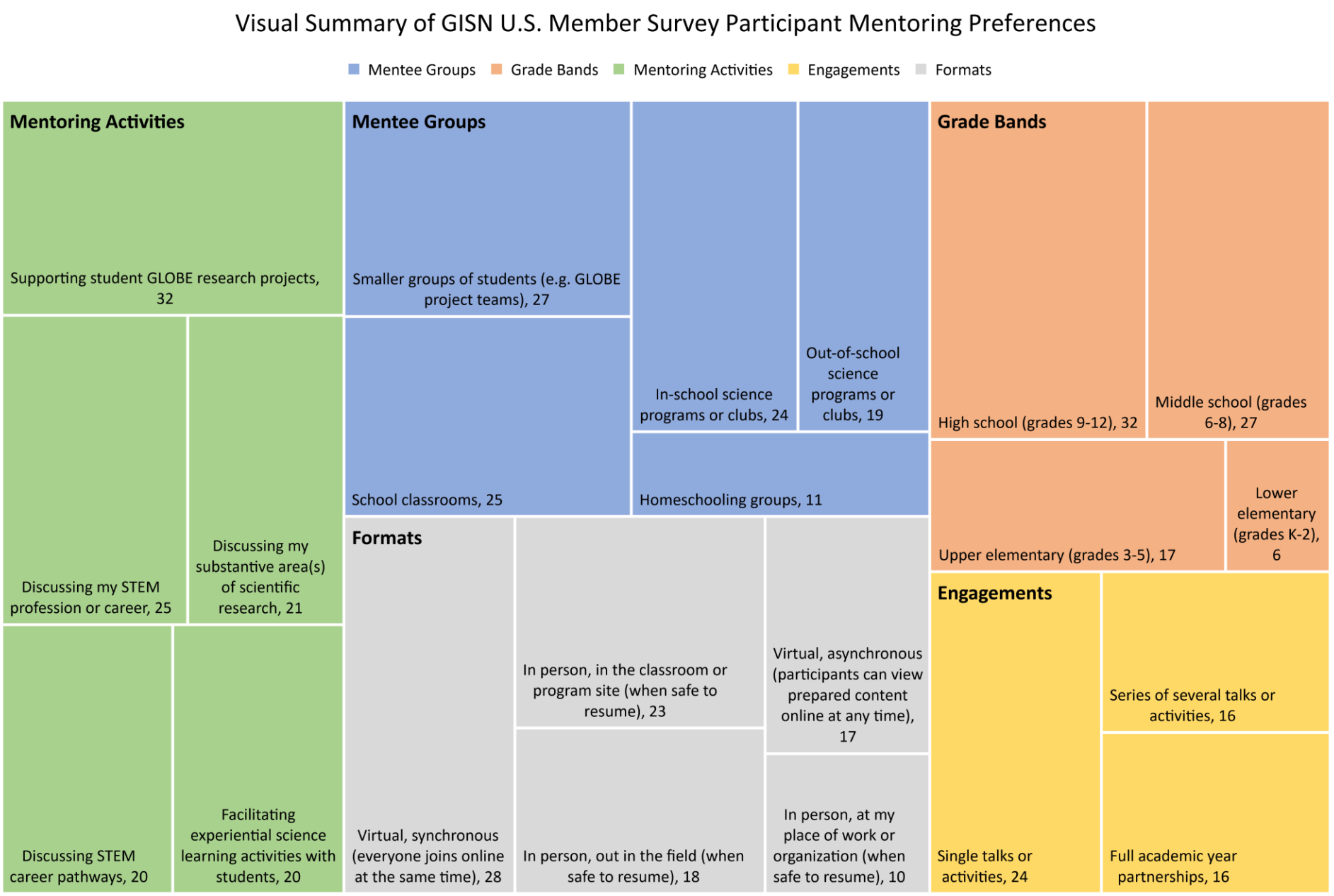

Figure 2. Participant mentoring preferences (n=36). Larger box area indicates a greater number of selections.