



Evaluation of the 2022 GLOBE U.S. Local  
Student Research Symposia:  
Temporary Pandemic Alternative or Future  
Complementary Activity?

**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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Project Prairie & GLOBE SRS at The Toledo Zoo & Aquarium, Toledo OH (Event Lead Jodi Haney)

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# Executive Summary

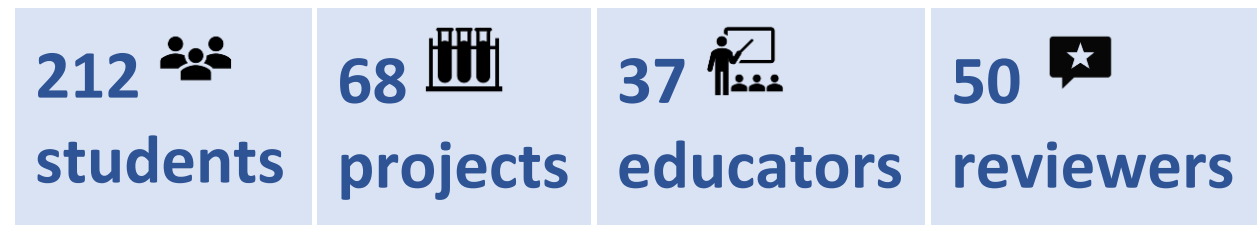
## Introduction

In 2022 the GLOBE U.S. Coordination Office offered small grants to support locally led Student Research Symposia (SRS) events, envisioned as a substitute for the larger regional SRS that had been canceled from 2019-2022 due to the COVID-19 pandemic. Financial support for the grants was provided by the National Aeronautics and Space Administration (NASA, Grant No. 80NSSC18K0135) and Youth Learning as Citizen Environmental Scientists (YLACES). Evaluation findings are intended to help GLOBE program leaders and sponsors understand the outcomes of these events and weigh their value as a one-time solution to bridge the gap to the next regional SRS in 2023 or as a complementary activity to continue. Data sources included local SRS event proposals and reports, school enrollment data, anonymous paper-and-pencil surveys conducted with participating students and educators at the events, and a reviewer survey and event team member survey conducted online after the events.

## About the Local SRS Events

The seven local SRS events took place in April and May of 2022 in five states: Alaska, California, Louisiana, New Mexico, and Ohio. They were held in a variety of venues from schools to conservation areas to an area zoo and aquarium. All of the events offered STEM professional and peer review of student research presentations and opportunities to meet STEM professionals, which were required for event funding. Most also offered opening remarks (6), opportunities to meet other students (5), and hands-on activities (5). About half (4) offered keynote speakers, career talks, and closing ceremonies.

## Participation in the Local SRS Events



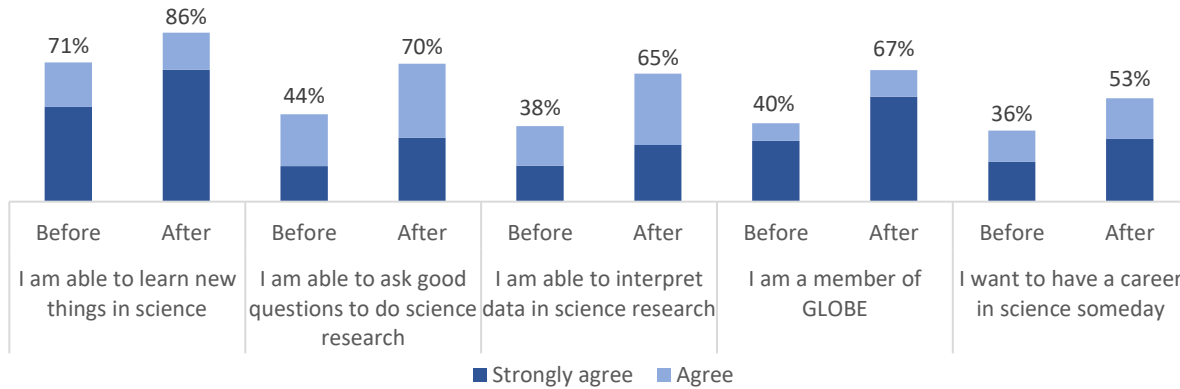
**54%** of students were from schools with the majority identified as **economically disadvantaged**.

**45%** of students were from schools with the majority identified as **Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native**.

A total of 212 students participated in the events and presented 68 projects. Thirty-seven educators and 50 reviewers also participated. Fifty-four percent of students and 52% of teachers participating in the events came from schools where a majority of students were identified as economically disadvantaged. Forty-five percent of students and 55% of teachers participating came from schools where a majority of students were identified as a race or ethnicity underrepresented in STEM, specifically Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native.

**Student survey results show significant positive change in self-reported science skills, interest, and self-efficacy, and GLOBE affiliation.**

More students *agreed* or *strongly agreed* after the events (n=164).



***[Before this event] I thought that it was going to be nerve-racky and stressful ... [but now I know] it was very informative, casual, and a good experience for my future in STEM. —Student at Family Night at the Museum with GLOBE***

***[Before this event I thought] that it was going to be boring ... [but now I know] it is exciting and a great way to learn. —Student at the Elkhorn Slough Reserve SRS***

***[Before this event] I did not know GLOBE existed ... [but now I know] GLOBE is worldwide and awesome. —Student at the Project Prairie and GLOBE SRS***

***Before this event, I thought scientists were old men ... now I know we have a lot more diversity in this area, it's truly inspiring! —Student at Family Night at the Museum with GLOBE***

Most students reported that they were *happy* (94%) and *excited* (87%) during the events. They most enjoyed 1) activities like going to the zoo and aquarium, building and playing games with drones, and going to a local body of water to see an invasive crab species, and 2) presenting their research.

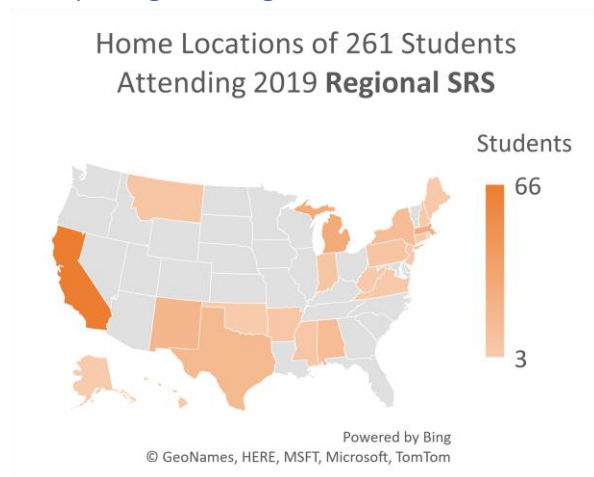
We learned from this evaluation that:

- **Novelty may improve student engagement and outcomes.** Students at all the events were generally happy and had positive outcomes, but it seemed to help to make the events different from their everyday science classes. New locations, activities, and people (students, GLOBE partners, etc.) may all contribute to novelty.
- **GLOBE affiliation was much higher after off-campus events.** After attending off-campus events, 77% of students agreed or strongly agreed that they are members of GLOBE, compared with 23% of students after attending events held at schools.
- **Career talks make a difference.** Average interest in a science career increased more than twice as much among students who attended events with a career talk (17%) than among students who attended events without a career talk (7%).

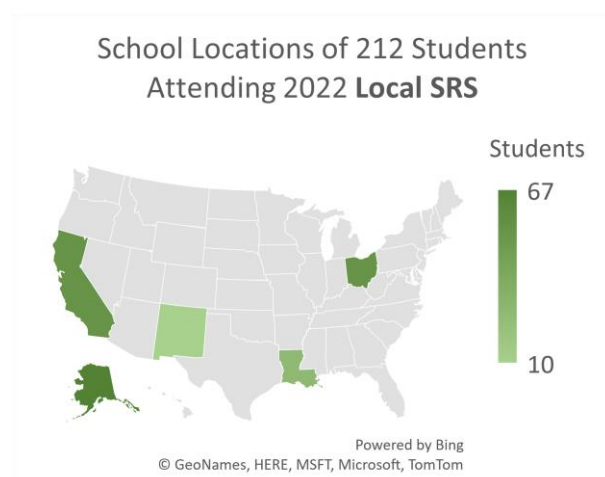
**98% of educators reported that participation improved their ability to integrate science research in their classroom or program.**

- 100% of educators were satisfied with the events as a science learning experience for students.
- 74% would definitely attend an SRS again in 2023 if it were safe, and the rest probably would.

### Comparing the Regional & Local SRS



- Offers greater geographical coverage across the country with fewer events
- Offers students more novel experiences, locations, and activities
- Brings together participants from diverse communities with different experiences and ideas to share
- More closely approximates national academic conferences
- Significant positive outcomes for students' science skills, interest, and self-efficacy



- May be more easily accessible for some students, especially younger students and students in remote geographical areas
- Introduces students to local ecosystems and science resources
- Can be more responsive to local cultures and ways of knowing
- Brings new students, educators, and reviewers into the GLOBE community
- Significant positive outcomes for students' science skills, interest, and self-efficacy

## Key Findings & Recommendations

**KEY FINDING:** Local SRS events reached underserved communities.

**RECOMMENDATION:** GLOBE’s sponsors help to cover scholarships, transportation, and other costs that can be a barrier to participation for the local and regional SRS. Continuing this sponsorship is critical to supporting GLOBE U.S. Partner efforts to broaden participation. The local SRS events in particular may have been more accessible to students who have barriers to travel. We will evaluate this further in 2023 by collecting comparable school data for the regional SRS.

**KEY FINDING:** Student survey results show significant positive change from before to after the events on every statement in our measure of science skills, interest, and self-efficacy, and GLOBE affiliation.

**RECOMMENDATION:** This evidence of the SRS model’s effectiveness for increasing student engagement in STEM warrants continuation and expansion of the events. Continue supporting the SRS, as well as efforts to broaden participation and address financial and logistical barriers so that more students can benefit from the opportunities at the local and regional levels.

**KEY FINDING:** Most students reported that they felt happy, excited, and focused during the events.

**RECOMMENDATION:** In addition to the required SRS components of the presentation and review, include activities that offer the opportunity for students to get up, get outside and have fun with their learning. Students enjoy the SRS overall but seem to find this type of activity especially engaging.

**KEY FINDING:** Our comparative analysis of events showed that career talks made a significant difference in the influence of the events on student interest in a science career, and that students who attended off campus events had significantly higher GLOBE affiliation after the events.

**RECOMMENDATION:** Include a career talk in future events. Incorporate novel elements such as new locations, activities, or people (students from other schools, GLOBE Partners or event site personnel as activity leaders, guest speakers). For school events, even holding the event in a different part of the school outside of the classroom, like the library, gym, or auditorium may offer some benefit.

**KEY FINDING:** Ninety-eight percent of educators reported that participating in the events improved their ability to integrate science research in their classroom or program. All of the educators were satisfied with the events as a learning experience for students, and all would definitely or probably attend a GLOBE SRS event in the future.

**RECOMMENDATION:** Continue efforts to engage educators in the SRS. The local SRS events may help to expand the GLOBE community by getting new educators involved.

**KEY FINDING:** Both the local and regional SRS show evidence of positive outcomes for student self-reported science skills, interest, and self-efficacy, and offer unique value for GLOBE U.S. programming.

**RECOMMENDATION:** Consider opportunities for local SRS events to complement—not duplicate—regional SRS going forward. Focus on how they can reach students, educators, and reviewers who may have barriers to participation in the regional SRS, or who may want to try out a local SRS before making the more substantial investment to attend a regional SRS. Allow the local events to develop and pilot test culturally responsive modifications to the SRS model to better serve their communities and offer guidance for other GLOBE communities or for GLOBE U.S. programs more broadly.

## Introduction

Global Learning and Observations to Benefit the Environment ([GLOBE](#)) offers an array of resources to support youth engagement in environmental research in the U.S. and worldwide, including learning activities, research protocols, data sharing, mentorship, educator professional development, and expert consultation. The GLOBE U.S. Coordination Office 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 GLOBE U.S. program is the [Student Research Symposia](#) (SRS) held annually in six GLOBE regions across the country. The regional SRS are organized by the GLOBE U.S. Coordination Office in collaboration with GLOBE U.S. Partners from each region. From its start in 2016 through 2019, a total of 894 students and 240 educators attended the regional SRS.<sup>1</sup>

The 2020 and 2021 regional SRS were canceled due to the COVID-19 pandemic. Although many in-person activities had resumed by 2022, concerns about the health and safety issues involved in large regional events remained. So the GLOBE U.S. Coordination Office tried something new. With financial support from the National Aeronautics and Space Administration (NASA, Grant No. 80NSSC18K0135) and Youth Learning as Citizen Environmental Scientists (YLACES), they offered small grants to support locally led SRS events via a request for proposals distributed to GLOBE U.S. Partners and educators. Seven proposals were submitted, and all seven events were funded with a total of \$26K in awards.

This report shares findings from our evaluation of the 2022 GLOBE U.S. local SRS events. It responds to these primary evaluation questions:

1. What were the characteristics of the events?
2. Who participated in the events?
3. How did participation influence student self-reported science skills, interest, and self-efficacy?
4. What can we learn from student, educator, reviewer, and local event team member feedback to inform future GLOBE U.S. programming?

These findings are intended to help GLOBE program leaders and sponsors understand the outcomes of these events and their reach into underserved communities. As the events were a novel and somewhat experimental response to the COVID-19 pandemic, the purpose is also to help leaders and funders weigh their value as a one-time solution to bridge the gap to the next regional SRS or as a complementary activity to pursue once the regional SRS are safe to resume.

## Evaluation Data Sources

Secondary data sources (existing data collected for another purpose) used for the evaluation include local SRS event proposals and reports and publicly available school enrollment data. Original data sources (data we collected for the evaluation) include anonymous paper-and-pencil surveys conducted with participating students ([Appendix A](#)) and educators<sup>2</sup> ([Appendix B](#)) at the end of the events, and a [reviewer survey](#) and [event team member survey](#) conducted online via Qualtrics survey platform after the events. Please see the relevant survey result sections for brief descriptions of survey administration and response rates and [Appendix C](#) for more detailed information about data collection and analysis.

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<sup>1</sup> Represents total of annual counts; students and educators who attended multiple years were counted each time.

<sup>2</sup> We are now transitioning from the term ‘teacher’ to ‘educator’ where applicable to include of out-of-school and informal science learning settings. Appended surveys have not been updated to preserve them as administered.



## Characteristics of the Local SRS Events

The seven local SRS events took place in April and May of 2022 in five states. They were held in a variety of venues from schools to conservation areas to a city zoo and aquarium. (Table 1.)

Table 1. 2022 local SRS event information.

Event Title	State	Site	Event Lead(s)
GLOBE Alaska SRS <sup>†</sup>	AK	Wedgewood Resort and Creamer's Field Migratory Waterfowl Refuge	Christina Buffington, Katie Spellman, Tohru Saito, & Nicole James
St. Peter's Science GLOBE Symposium <sup>†</sup>	OH	St. Peter's High School	Janene Smith
New Mexico GLOBE SRS <sup>†</sup>	NM	Mescalero Apache School	Nate Raynor & Marcia Barton
Family Night at the Museum with GLOBE <sup>†</sup>	CA	Chabot Space & Science Center	Tracy Ostrom
Elkhorn Slough Reserve GLOBE SRS	CA	Elkhorn Slough National Estuarine Research Reserve	Peggy Foletta
Greater New Orleans GLOBE Science Symposium	LA	Kenner Discovery Health Sciences Academy	Kristin Robertson Oliveri
Project Prairie & GLOBE SRS	OH	Toledo Zoo & Aquarium	Jodi Haney

<sup>†</sup>Sites also supported by [NASA Science Activation](#) funded Partnerships

All seven events offered STEM professional and peer review of student research presentations and opportunities to meet STEM professionals, which were required for event funding. Most also offered opening remarks (6), opportunities to meet other students (5), and hands-on activities (5). About half (4) offered keynote speakers, career talks, and closing ceremonies. (Figure 1.) Individual events also offered family activities, cultural performances, a game night, and GLOBE educator training. For an event-level breakdown of activities, see the tables in [Appendix D](#).

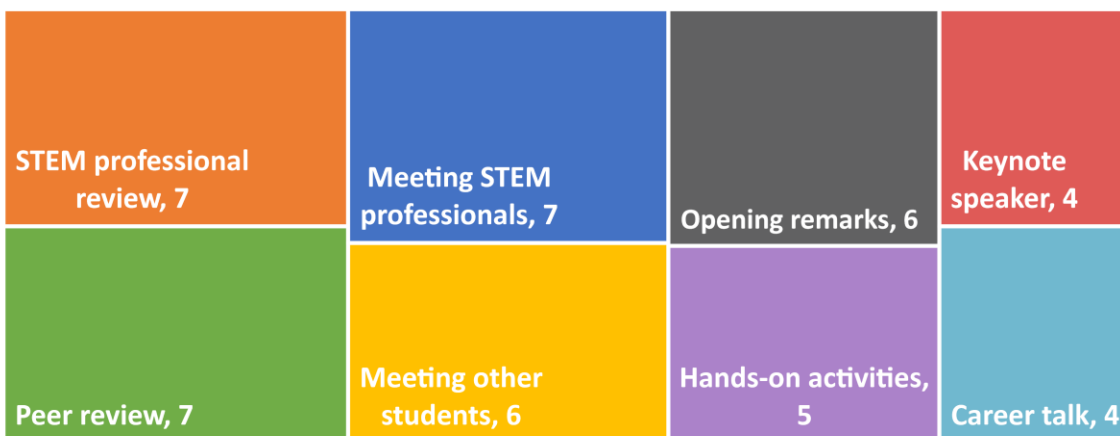
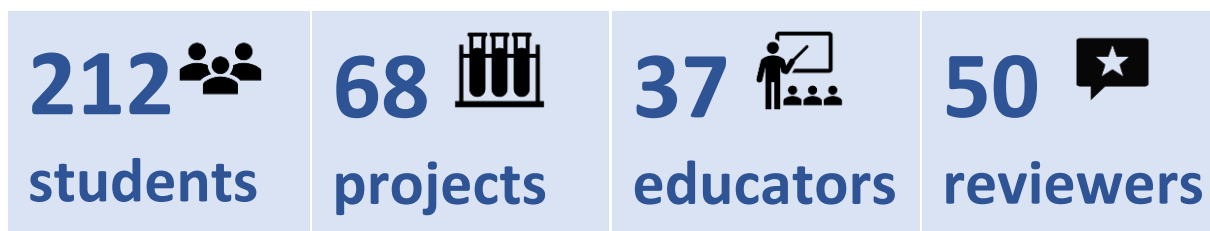


Figure 1. Number of 2022 local SRS events with each activity.

## Participation in the Local SRS Events



**54%** of students were from schools with the majority identified as **economically disadvantaged**.

**45%** of students were from schools with the majority identified as **Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native**.

According to the event reports submitted to the GLOBE U.S. Coordination Office by the event leads, a total of 212 students participated in the events, and students presented 68 projects. Thirty-seven educators and 50 reviewers also participated. For an event-level breakdown of participation, please see tables in [Appendix D](#).

The event reports also included the schools of participating students and teachers. Using this information, we obtained publicly available data on 2021-22 academic year school enrollment demographics.<sup>3</sup> We found that 54% of students and 52% of teachers participating in the events

came from schools where a majority of students identified as economically disadvantaged.<sup>4</sup> Forty-five percent of students and 55% of teachers participating came from schools where a majority of students identified as a race or ethnicity underrepresented in STEM, specifically Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native.<sup>5</sup>

The participation data show that event attendance included a substantial proportion of students from low-income communities who may not have easy access to STEM education resources and communities underrepresented in STEM fields, as well as teachers serving these communities. Although this information alone cannot tell us about the experience of inclusiveness at GLOBE events for students from underrepresented communities, it helps us understand the extent to which the program is addressing barriers to participation, thereby broadening access to STEM learning opportunities.

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<sup>3</sup> Data for private and tribally-controlled schools (representing a total of 17 students and 4 teachers) were not located for the 2021-22 academic year and were treated as missing for analysis of economically disadvantaged students in the student participant population. For private schools, they were also treated as missing for analysis of racial and ethnic identity. Tribally-controlled schools were counted as having a majority of Native American or Alaskan Native students based on available information about school mission and enrollment policies.

<sup>4</sup> “Economically disadvantaged” is defined by each state, and typically involves individual or household eligibility for federal assistance programs. Different states include different federal assistance programs in their criteria for identifying economically disadvantaged students (Blagg & Gutierrez, 2021).

<sup>5</sup> We acknowledge the limitations of these categories to represent the range of regional and cultural identities comprising them, which may differ in their representation in STEM. See for example Bhatti (2021).

## Student Survey Results

This section reports the results of the anonymous student survey collected at the end of the local SRS events. The student survey was conducted to evaluate the influence of the events on students' self-reported science skills, interest, and self-efficacy, and to get student feedback on the events to improve future programming. One hundred sixty-four of the 212 students participating in the events (77%) completed the survey. The results are presented here in aggregate. Student quotations from responses to open-ended questions are identified by the event they attended. Please see [Appendix C](#) for more information on data collection and analysis and [Appendix E](#) for statistical test results tables.

### Science Skills, Interest, & Self-Efficacy Outcomes

**Student survey results show significant positive change in science skills, interest, and self-efficacy, and GLOBE affiliation.**

In the post-event survey, students rated their agreement with nine positively worded statements about their science skills, interest, and self-efficacy and their GLOBE affiliation before and after the event on a scale of 1 'strongly disagree' to 6 'strongly agree'. This type of measure is known as *retrospective pre-post* because it asks participants to think back to what they believed at an earlier time and compare it to what they believe in the present time. The results show significant positive change<sup>6</sup> from before to after on every statement and the summed score of all statements (Table 2.)

Table 2. Student retrospective pre-post mean ratings of agreement with statements about science skills, interest, and self-efficacy before and after the events on a scale of 1 'strongly disagree' to 6 'strongly agree'.

Statement	n	Mean	
		BEFORE	AFTER
I am able to learn new things in science.***	159	4.99	5.46
I am able to ask good questions to do science research.***	159	4.15	4.82
I am able to interpret data in science research.***	158	4.08	4.75
I am able to conduct peer review of other students' science research.***	160	4.16	4.76
I am good at science.***	158	4.20	4.80
I enjoy science.***	157	4.83	5.19
I want to have a career in science someday.***	158	3.75	4.26
I am proud of my accomplishments in science.***	158	4.60	5.09
I am a member of GLOBE.***	154	3.65	4.77
<b>SUMMED SCORE***</b>	<b>146</b>	<b>38.56</b>	<b>43.72</b>
*** $p < .001$			

The total percentage of students *agreeing* or *strongly agreeing* with every statement about science skills and self-efficacy increased from before to after, as did the percentage *strongly agreeing* (Figure 2.) The same is true for all the statements about science interest and GLOBE affiliation (Figure 3).

<sup>6</sup> Paired samples t-tests. See Appendix E for test tables.

More students *agreed* or *strongly agreed* with statements about their science skills and self-efficacy after the events than before (n=164).

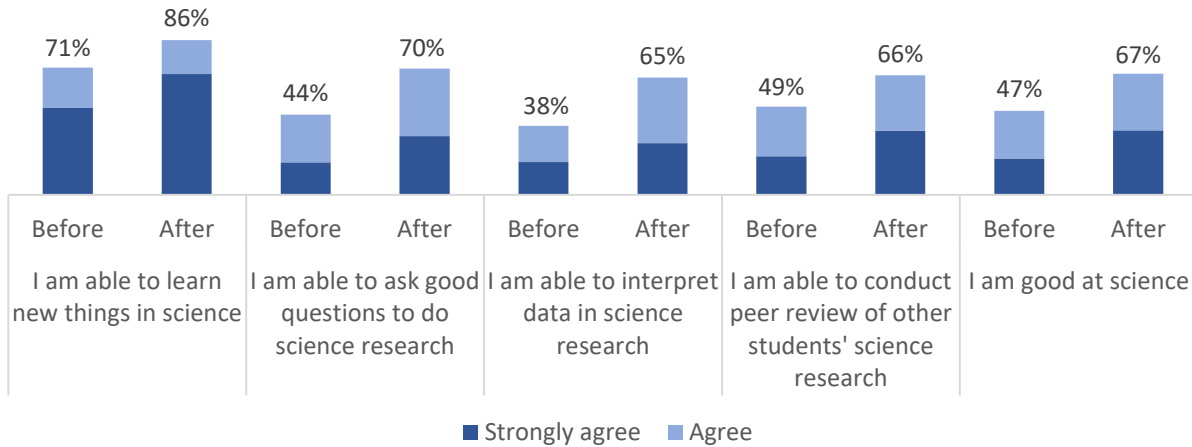


Figure 2. Percentage of students agreeing or strongly agreeing with statements about their science skills and self-efficacy before and after the events in a retrospective pre-post measure (n=164).

Figure 2 above shows the statements related to science skills and self-efficacy. 'I am able to learn new things in science' had the highest percentage agreement at the end with 86%, but the biggest changes were in 'I am able to interpret data in science research' which increased by 27 percentage points, and 'I am able to ask good questions to do science research' which increased by 26 percentage points.

More students *agreed* or *strongly agreed* that they enjoy and take pride in science, want science careers in the future, and are members of GLOBE after the events than before (n=164).

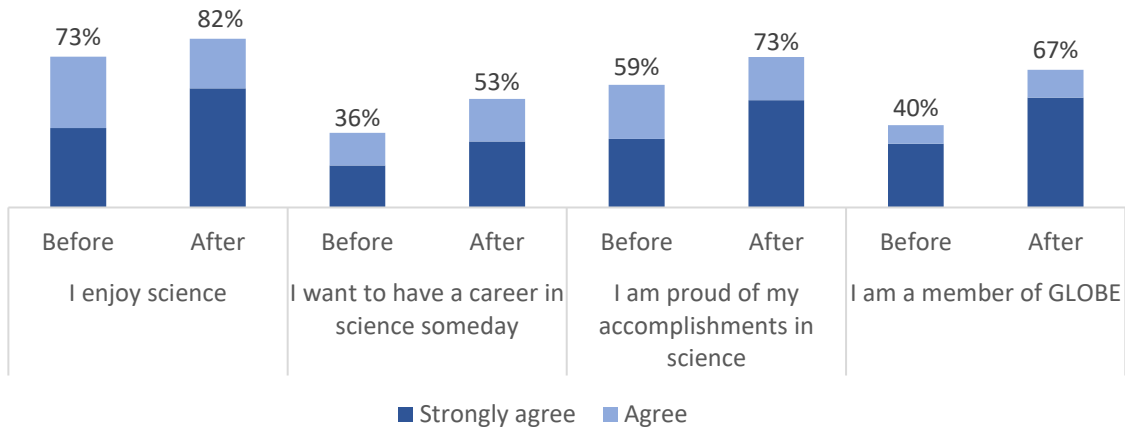


Figure 3. Percentage of students agreeing or strongly agreeing with statements about their science interest and GLOBE affiliation before and after the events (n=164).

Figure 3 above shows statements related to enjoyment of and pride in science, interest in science careers, and GLOBE affiliation. Here the highest percentage agreement at the end was for 'I enjoy science' with 82%, but the biggest change by a wide margin was in agreement with 'I am a member of GLOBE,' which increased by 27 percentage points.

The post-survey asked students to complete the statement, “before this event I thought ... but now I know ...” to learn how they described the influence of the events in their own words. The responses were coded by sentiment (positive, neutral, or negative) before and after the event and by the themes they referenced. Some responses referred to multiple themes. As a result, the thematic references exceed the total number of responses. Here we discuss the major themes that emerged.

Of 153 responses, 131 (86%) indicated movement from negative or neutral to positive sentiment (123) or maintaining or increasing already positive sentiment (8) towards science, the SRS, or related experiences. Comments indicating positive sentiment at the end of the events most frequently referenced finding the SRS more fun or interesting than expected (45). Many students came into them thinking they would be “scary,” “boring,” “serious,” or “stressful,” but left describing them as “fun,” “easy,” “laid back,” “lively,” and “not competitive.” Examples in this theme included:

***[Before this event] I thought that it was going to be nerve-racky and stressful ... [but now I know] it was very informative, casual, and a good experience for my future in STEM.*** —Student at Family Night at the Museum with GLOBE

*It would be scary and boring ... it was fun and everyone was nice.* —Student at GLOBE Alaska SRS

*It was gonna be long and was just going to be presentations ... it was fun and I learned new things about science.* —Student at New Mexico GLOBE SRS

*That it was going to be boring ... it is exciting and a great way to learn.* —Student at the Elkhorn Slough Reserve GLOBE SRS

Even a student that already anticipated enjoying the GLOBE Alaska SRS found that it exceeded their high expectations, saying, “I thought that this was just going to be fun ... but now I know that it was more than just fun. It was super fun.”

Similarly, many students found the research presentation less stressful or difficult than anticipated (32). These students described feeling nervous or concerned they would not do well before the event. But with a few exceptions, most discovered that they were capable of presenting. Some even enjoyed it and described it as a good learning experience. One student from the GLOBE Alaska SRS recalled, “I thought I would be very scared,” but learned that “it wasn't so bad.” A student from the Project Prairie and GLOBE SRS expected that “it just would make me nervous to present,” but came to find “it was a lot of fun.”

Multiple comments from students at Family Night at the Museum with GLOBE described fairly significant transformations in their thinking about the value of their presentations, for example:

*I was nervous to present ... I enjoy meeting new people and sharing something I worked hard on.*  
—Student at Family Night at the Museum with GLOBE

*Our presentation needed to be perfect. ... symposiums are an opportunity to get feedback and improve as a scientist.* —Student at Family Night at the Museum with GLOBE

*It would be scary and nerve-racking, people evaluating would be harsh and have high expectations on us ... that it's a fun event where we explain and learn more about science.*  
—Student at Family Night at the Museum with GLOBE



Photo: Family Night at the Museum with GLOBE at the Chabot Space & Science Center, Oakland CA (Event Lead Tracy Ostrom)

*I thought I was going to be nervous and won't do very well ... it's OK if you don't know something and there's always more to learn. —Student at Family Night at the Museum with GLOBE*

*[Before this event I thought] that I would mess up everything ... [but now I know] that science is pretty cool and fun and showing results makes me feel good. — Student at Family Night at the Museum with GLOBE*

In a related theme, students described feeling more confident and able to participate in science (24). Some of these comments were coded for their references to presenting as well, but others described broader change. For example, a student at the GLOBE Alaska SRS thought that “I wasn't good at science,” before the SRS, and after declared, “now I know I know science.” A student at the Project Prairie and GLOBE SRS feared “that I was going to do terrible,” but learned “that I am NOT terrible at science.” A student at the Elkhorn Slough Reserve GLOBE SRS previously believed “there weren't many ways to conduct research,” but after the event recognized “I can do many things to conduct research.”

Some of the comments described learning new things in science (21). A student at the Project Prairie and GLOBE SRS thought “prairies weren't that important ... now I know that they provide so much for our environment.” A student at the St. Peter's Science GLOBE Symposium “did not know anything about aerosols,” but now knows “about aerosols and certain surface temperatures.” Other examples include:

*That air quality didn't affect much, that nothing really was important as it really is ... that air quality is actually important and affects a lot. —Student at New Mexico GLOBE SRS*

*I didn't think I would learn about the many parts that contribute to testing the water ... me ciento contenta porque aprendi muchas cosas nuevas sobre las propiedades del agua. [I feel happy because I learned many new things about the properties of water.] —Student at the Elkhorn Slough Reserve GLOBE SRS*

*Only carbon affects global warming ... trees, clouds, and the ground cover affects global warming. —Student at the Greater New Orleans GLOBE Science Symposium*

Another student at the Greater New Orleans GLOBE Science Symposium seems to have heard a call to action in what they learned, reporting that before the event they thought it “was gonna be silly and useless,” but now know that “Mother Nature needs US.”

Thirteen comments referenced a new awareness of GLOBE and NASA and the opportunities these organizations present. A student at the GLOBE Alaska SRS made the connection between GLOBE and NASA, having previously thought “you had to be a professional to be involved in NASA data,” but learning that “through GLOBE you don’t.” Notably, the remaining 12 of the 13 comments referencing this theme were all from students the Project Prairie and GLOBE SRS. One experienced both this new awareness and a boost of confidence, saying “no I could not do it and I didn’t know about GLOBE ... I can do it and I know about GLOBE now,” and another at the same event thought “that I would never work with NASA ... that I can work with NASA and it’s super cool.” Other examples include:

*I did not know about GLOBE ... I know that I can do GLOBE research.* —Student at the Project Prairie and GLOBE SRS

*[I did not know] GLOBE was a thing or I could help NASA with my research ... GLOBE is very helpful and I can help NASA.* —Student at the Project Prairie and GLOBE SRS

***[Before this event] I did not know GLOBE existed ... [but now I know] GLOBE is worldwide and awesome.*** —Student at the Project Prairie and GLOBE SRS

In other comments, students described discovering that science in general is more fun, cool, or interesting than they thought before. A student from the St. Peter’s Science GLOBE Symposium “thought that science was boring and I really [didn’t] understand it ... now I know that science could be fun.” A Project Prairie and GLOBE SRS student previously believed “that life and nature was kind of boring,” but discovered “that there is so much to science!” Two students explained what they learned about how science and the SRS could be fun, interesting, and relevant for them:

*It would be long and boring ... science is fun when I am talking about things that I am interested [with] others that are also interested.* —Student at Family Night at the Museum with GLOBE

*I was not very excited for science fair projects. I was never very interested in giving effort toward my projects ... Science can be made interesting to you. Experiments and data can be fun to collect if you base it off things you are interested in.* —Student at the Greater New Orleans GLOBE Science Symposium

Seven students found that the STEM professionals at the events were different from their expectations, mostly in the context of their feedback on the presentations. For example, a student at the Greater New Orleans GLOBE Science Symposium feared “the criticism would be harsh,” but found that “the judges were very kind.” Related to their positive comments about presenting, five of the seven comments referencing this theme were again from students at Family Night at the Museum with GLOBE. One thought “that presenting to experts would be very challenging,” but found that “they were very easy to talk to and that I learned a lot from them.” Another “was nervous about presenting and slightly scared about who we presented to,” but felt that “most were very laid back and easy to talk to.” A third was concerned “that it was going to be really scary because there was going to be a lot of people,” but found “that scientists are awesome and really cool people to talk to.” Others described their experiences:

***Before this event, I thought scientists were old men ... now I know we have a lot more diversity in this area, it's truly inspiring!*** —Student at Family Night at the Museum with GLOBE GLOBE

***I thought that it would be a very intimidating experience because of the word "scientist" and that I might mess up and not answer questions. ... The scientists were SUPER friendly! They were polite, funny, and respectful. I still couldn't answer questions, but I had a fun learning experience!*** —Student at Family Night at the Museum with GLOBE

The remaining references in comments ending in positive sentiment (24) included a variety of other aspects of the SRS, science learning, and other learning. Some of these referenced expectations of the SRS. For example, a student at the Elkhorn Slough Reserve GLOBE SRS expected “that I am going in a big building to participate,” and found that “this is [a] beautiful place to learn how science works,” suggesting a change in beliefs about where and how people can do science. Similarly, a student at the GLOBE Alaska SRS “thought it was a laboratory ... but now I know it is not.”

For one Project Prairie and GLOBE SRS student, the event exceeded their expectations; they thought “that our project was for a small event,” but had the opportunity to “[meet] with real scientists. It was a large event.” Another student from the same event thought their “presentation was just for a grade,” but came to recognize “the presentation is for scientists around the world.” A student at the Greater New Orleans GLOBE Science Symposium previously thought that “Science Fair was the only way to interact with other students that were interested in the sciences,” and learned that with GLOBE “there are events designed for students to interact with one another and learn about the sciences.”

Comments that moved from positive or neutral to negative sentiment or maintained negative sentiment were few (9) and primarily fell into two themes. One was feeling negative about science or about presenting. For example, a student from Family Night at the Museum with GLOBE thought the event “would not be intimidating” but afterwards felt that “it was,” and a student at the Greater New Orleans GLOBE Science Symposium reported they “don’t want to have a scientific career” both before and after the event. The other primary theme for comments ending in a negative sentiment suggested that the students were not prepared to present or were unaware they had to present and were unhappy to learn this was the case. For example, a student at the GLOBE Alaska SRS thought “we didn’t have to present our poster and it will be fun ... we had to present our poster and it was not that fun.” The comments beginning and ending with neutral sentiment (4) mostly referenced factual information about the event, for example, “how are we going to present? We split up into groups,” from a student at the Project Prairie and GLOBE SRS. The sentiment was unclear for the remainder of the comments (9).



## Student Event Satisfaction

Students rated aspects of their engagement in the events on a scale of YES! to NO! with items from the [Science Learning Activation Lab](#) engagement survey (Chung et al., 2016; see [Appendix C](#)). The results show that many of the students enjoyed the events and were focused on the activities. (Figure 4).

Most students felt *happy*, *excited*, and *focused* during the events.

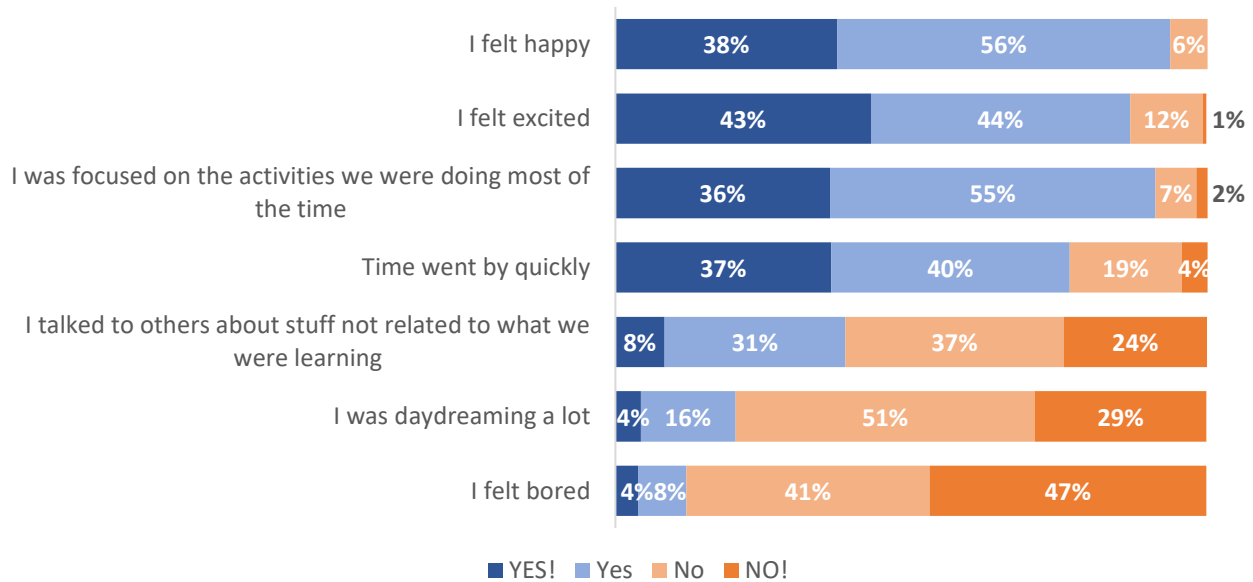


Figure 4. Students rate aspects of their engagement at the events (n=162).

Ten percent of students reported feeling both *bored* and *happy* during the events, and 8% reported feeling both *bored* and *excited*, accounting for most of the students that reported feeling bored. Students may have experienced a range of reactions to different activities over the course of the events and these survey items were not mutually exclusive.

We asked students what they ENJOYED MOST about the events in an open-ended question, and they frequently referenced more than one thing in their responses. Various event activities or activities in general were referenced in a total of 81 of the 163 comments (50%), most frequently by the students at the Project Prairie and GLOBE SRS who visited the Toledo Zoo and Aquarium (26), students at the GLOBE Alaska SRS who built and played games with drones (15), and students at the Elkhorn Slough Reserve GLOBE SRS who went to a local body of water to see an invasive crab species (8). Other students at the GLOBE Alaska SRS enjoyed learning about water pH testing and snow and ice (5), and students at the Greater New Orleans GLOBE Science Symposium also enjoyed water testing (2) and measuring surface temperature (2). Of course, the number of specific activity references is driven at least in part by the number of students attending each event. The takeaway should not necessarily be that one activity is better than another but rather that students generally seem to like getting up, getting outside, and having fun with their learning during the events.



Photos: LEFT - Elkhorn Slough Reserve GLOBE SRS at the Elkhorn Slough National Estuarine Research Reserve, Watsonville CA (Event Lead Peggy Foletta) ; RIGHT – New Mexico GLOBE SRS at the Mescalero Apache School, Mescalero NM (Event Leads Nate Raynor & Marcia Barton)

Presenting was referenced in 41 of the 163 comments (25%), the most of any single program component consistent across all of the events. Students at the GLOBE Alaska SRS commented, “this was my first time making a poster and it was really fun,” “I enjoyed doing the posters and talking to different people,” and “I [got] to share my work with others and then they can learn more.” Students at the Elkhorn Slough Reserve GLOBE SRS reported, “I enjoyed sharing our data that we collected to other people,” “it was ... cool to present to the other people,” and “I enjoyed everything about the event from listening to presenting to others. I truly learned a lot.” A student at the Project Prairie and GLOBE SRS similarly shared that they “liked presenting and looking at others’ presentations,” and a student from the New Mexico GLOBE SRS enjoyed “going over our presentations 😊, and giving opinions, and also meeting new people.”

As with the “before ... now” statements, the students at Family Night at the Museum with GLOBE again had many positive things to say about presenting (15), including “I enjoyed presenting with my team and talking to so many different experts,” “I enjoyed talking about our research. I also liked the ideas they had to improve our work,” “I loved talking to people about the water quality where we live. Getting to bond with the scientists was so much fun 😊,” and “I enjoyed presenting my share of the poster! I had a fun time learning after every time and working with my team!”

### **Students MOST ENJOYED activities and presenting.**

The students at Family Night at the Museum with GLOBE contributed most of the positive comments about the review by STEM professionals (12 of 14) and meeting and talking with STEM professionals (10 of 11) as well. Their comments included, “I really enjoyed the feedback and criticism. I now know what to do better next time,” “I enjoyed getting feedback from the scientists on how to improve our project and graphs,” and “I enjoyed most the opportunity to receive feedback from professionals and receive their input in respectful ways.” They appreciated the opportunity to “talk

to real STEM scientists” and “talking with very nice and professional people and learning from them too.” Students at the Greater New Orleans GLOBE Science Symposium also enjoyed “the professional critique and guidance given,” and “the feedback I was given,” and a student at the Alaska GLOBE SRS enjoyed “being able to talk to professionals on how to better my project.”

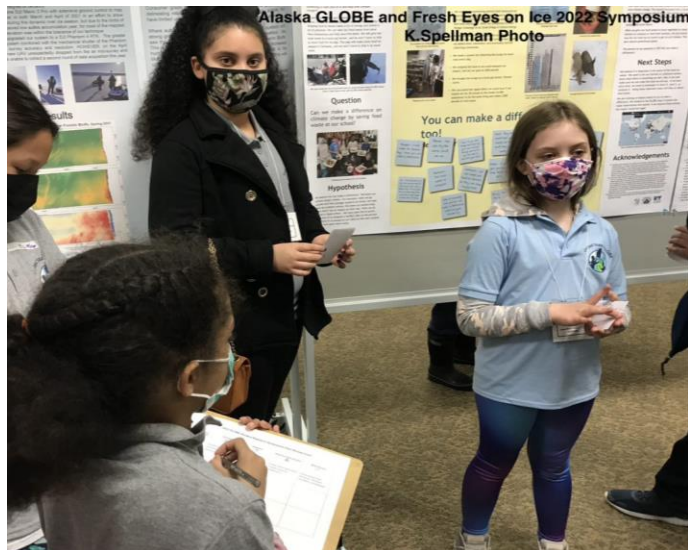


Photo: Alaska GLOBE SRS at Wedgewood Resort & Creamer’s Field Migratory Waterfowl Refuge, Fairbanks AK (Event Leads Christi Buffington, Nicole James, Tohru Saito, Elena Sparrow, & Katie Spellman)

Students enjoyed seeing the other presentations too (21). Students at the St. Peter’s Science GLOBE Symposium enjoyed “seeing all the great work they did,” “how students approached their projects in unique ways,” “seeing all the kids get excited about their projects.” Students at the Greater New Orleans GLOBE Science Symposium liked “looking at my peers’ projects and receiving their feedback,” and “seeing other projects in earth and environmental sciences.” Students at the New Mexico GLOBE SRS appreciated the “wonderful presentations” and “knowing everyone was interested in what they were presenting,” with one explaining further that they enjoyed how the presentations “connected their personal experiences, communities, problem/solutions, data/statistics, and many more.”

Nineteen comments (12%) referenced the event in general or different aspects of the event experience, for example, “I enjoyed all of it,” from a student at the GLOBE Alaska SRS, “It was a bunch of fun,” from a student at the Project Prairie and GLOBE SRS, and “the atmosphere of the event,” from a student at St. Peter’s Science GLOBE Symposium. Students from the Elkhorn Slough Reserve GLOBE SRS commented that “the people were nice and it was a new learning experience,” and “I enjoyed being surrounded by friendly and welcoming staff. I also liked being out [in] nature and exploring new things.”

Seventeen comments (10%) referenced food at the events. The remaining references were to the social aspects of the events such as meeting new people, talking with each other, and spending time with friends (13), peer review (5), something specific they learned in science (4), the venue (3) and other things (9) including “lots of water everywhere,” “free stuff,” and “getting interviewed by the news” contributed by students at the Alaska GLOBE SRS.

We also asked students what they ENJOYED LEAST about the events, and the most frequent response with 41 of 162 references (25%) was some variation on “nothing” or “I liked everything.”

The most frequent response otherwise was presenting with 35 references (22%). When an explanation for the response was given, it was typically feeling nervous or shy. In several cases the students were dissatisfied with their posters, and several mentioned either having to wait before or after their part of the presentation or there not being enough time for their presentation. However, two students from Family Night at the Museum with GLOBE described feeling better about the presentation by the end,

recalling that “presenting was a little scary the first time but the second and third time was fine,” and “it was a bit slow at first but the more we presented, the more enjoyable and less stressful it got!”

Related to presenting, three students enjoyed the STEM professional review least, finding it “intimidating” and “stressful.” Seven also enjoyed doing the peer review least. Most of these students did not enjoy rating the other projects and filling out the review forms.

Twenty-four comments (15%) referenced the weather being too cold, too windy, or too hot. Of the remaining comments, 12 referenced the event schedule, with some students feeling the events or certain event activities were too long or too short, or that there was too much waiting time. Eight referenced the event space being too small, crowded, or loud, with too many people talking at once. The rest referenced the food (3), travel (2), or other aspects of the event or the event in general (6).

Finally, students were given the option to tell us anything else about the events they would like. All but five of the 72 responses offered positive feedback or gratitude for the events. For example, a student at the Alaska GLOBE SRS said, “that was interesting and I hope that you (GLOBE) do it next year.” A student at the Project Prairie and GLOBE SRS “personally thought it was a great experience! I loved it,” and another reported “today I met NASA and I’ve always wanted to meet NASA.” A student from the New Mexico GLOBE SRS “found it very interesting and I would want to join GLOBE.” An Elkhorn Slough Reserve GLOBE SRS student “enjoyed working with ‘GLOBE’ members and had so much fun trying out new things,” adding “thank you so much for this great opportunity.” Another was “impressed with the idea of connecting with other people through science specifically through our local environments.”

### Student Outcomes by Event Characteristics

We conducted comparative analyses to explore the relationships between event characteristics and student outcomes. The purpose was not to compare the merits of the events but rather to learn what components may have contributed to their impact. Student results showed a similar overall pattern of significant positive change in science skills, interest, and self-efficacy across the board, but there were a couple of notable variations detected.

The results show that career talks made a difference. Change in agreement with the statement ‘I want to have a career in science someday’ from before to after interacted with career talks in the event agenda, producing significantly greater change as well as significantly higher agreement when there was a career talk.<sup>7</sup> The percentage of students *agreeing or strongly agreeing* increased by 23 percentage points to 64% at events with a career talk compared to an increase of seven percentage points to 37% at events without a career talk (Figure 5).

Students at events with career talks *agreed or strongly agreed* more that they are interested in science careers and had greater change before to after.

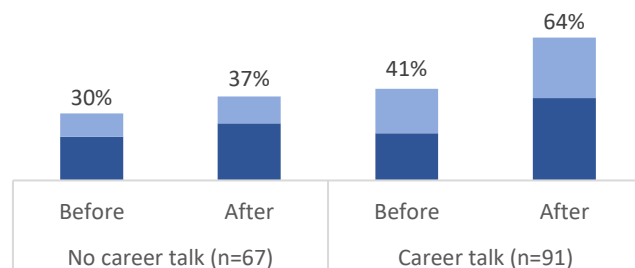


Figure 5. Percentage of students agreeing or strongly agreeing with the statement ‘I want to have a career in science someday’ before and after the events, by events without and with career talks.

<sup>7</sup> See test tables in [Appendix E](#).

More students attending off campus events *agreed* or *strongly agreed* that they are members of GLOBE both before and after the events.

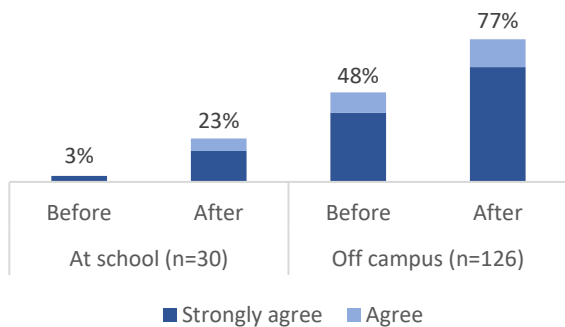


Figure 6. Percentage of students agreeing or strongly agreeing with the statement 'I am a member of GLOBE' before and after the events, by at school or off campus events.

Additionally, students who attended events off school campus agreed significantly more with the statement 'I am a member of GLOBE' both before and after the events than students who attended events at schools. By after the events, 77% of students who attended off campus events *agreed* or *strongly agreed* with the statement compared with 23% of students who attended events at schools (Figure 6). The change from before to after was not significantly different, however—GLOBE affiliation increased significantly for both groups.<sup>8</sup> It is not clear what caused these results. A possible explanation is that even planning to attend an event off campus starts to build GLOBE affiliation, and then attending the event contributes further.

There were several other significant (if less dramatic) differences that suggest greater success for off campus events by virtue of their taking place off campus. However, this may not be the underlying reason. A closer look at the data reveals variation in the results across the three school events, and evidence that school events can be as effective as—or even more effective than—off campus events. A possible explanation is that novel elements increase engagement and improve outcomes. Novel elements may include new locations, activities, or people (students from other schools, GLOBE Partners or event site personnel as activity leaders, guest speakers) that differentiate the GLOBE event from a typical day of class. Off campus events start with the advantage of a novel location. However, for school events, even holding the event in a different part of the school outside of the classroom, like the library, gym, or auditorium may offer some benefit.

<sup>8</sup> See test tables in [Appendix E](#).

## Educator Survey Results

This section reports the results of the anonymous educator survey collected at the end of the local SRS events. The educator survey was conducted to assess the influence of event participation on integration of research into science teaching, and to get educator feedback on the events to improve future programming. According to the event reports, 37 educators participated in the events. However, 42 educator surveys were completed. It is possible that non-participating educators serving as event chaperones also completed the survey; only 36 of the 42 educators reported their students presented research at the events. Please see [Appendix C](#) for more information. The results are reported in aggregate. Educator quotations from responses to open-ended questions are not identified by event title as there were not enough educators at every event to do so without presenting a privacy risk.

### Science Teaching Outcomes

**98% of educators reported that participation improved their ability to integrate science research in their classroom or program.**

In response to a yes or no question, nearly all of the educators who took the survey (98%) reported that ‘participating in the event improved [their] ability to integrate science research in their classroom or program.’ The 36 educators who had students presenting research at the events told us which GLOBE resources they used prior to the event for their science teaching and rated them on a scale of ‘not at all helpful’ to ‘very helpful’ (Figure 7).

Most educators found the GLOBE resources they used prior to the event *very helpful* or *helpful* for their science teaching; usage varied by resource.

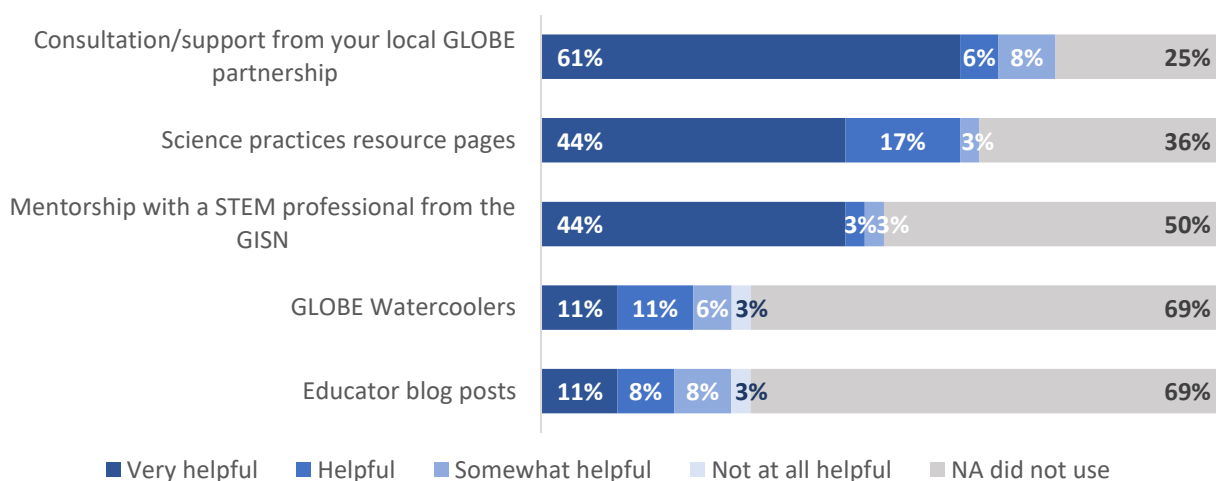


Figure 7. Educator ratings of the helpfulness of GLOBE resources for their science teaching (n=36).

Over half of the educators used consultation or support from their local GLOBE partnership (75%), science practices resource pages (64%), and mentorship with a STEM professional from the GLOBE International STEM Network (GISN) (50%). A little under a third (31%) used the GLOBE Watercoolers and educator blog posts. Although usage varied by resource, the majority of those that used each resource

rated them *very helpful* or *helpful* for their science teaching, especially the science practice resource pages (96%), mentorship with a STEM professional from the GISN (95%), and consultation/support from their local GLOBE partnership (91%). Educators also wrote in eight ‘other’ GLOBE resources they used prior to the event, rating them all *very helpful*. These included the support of individuals they listed by name (3), research equipment (2), and GLOBE training (1), as well as food and travel support for the event itself (2). One educator added in a marginal note:

*Thank you for supporting the ~\$2000 in travel costs for us to attend. We are enormously grateful! Access to programs like this for students from rural [area] is extremely expensive, and we are so appreciative of your travel scholarship removing that barrier. – Educator*

### Educator Event Satisfaction

All of the educators (100%) who completed the survey reported that they were *very satisfied* (88%) or *satisfied* (12%) with the events as a science learning experience for the students. Many (81%) had never attended a GLOBE SRS before. All (100%) reported that they would *definitely* (74%) or *probably* (26%) attend a local GLOBE event next year, referring to 2023.

**100% of educators were satisfied with the events as a science learning experience for students.**

**74% would definitely attend an SRS again in 2023 if it were safe.**

Additionally, all (100%) reported that they would *definitely* (75%) or *probably* (25%) attend an SRS next year if it were safe, referring to the context of the evolving COVID-19 pandemic. Due to the wording of the survey question, however, it is not clear if the educators understood this to mean a regional or local SRS; at the time of survey development, we did not know that the local events would also be titled SRS. Whatever the interpretation though, it is clear that there was substantial interest among this group of educators who were mostly new to GLOBE events to continue their engagement in the future.

Educators were asked what was MOST SUCCESSFUL about the events. In their 42 responses they most frequently referenced the presentations (12), and some relatedly referenced the STEM professional review (6), opportunities to interact with scientists (5), and peer review (5). Some of these comments also referenced going somewhere new and connecting across communities. Educators appreciated the “the opportunity for students to present, practice public speaking, and visit somewhere new with STEM [professionals],” “the connection made with different communities, for the children to present their project, and meet with scientists,” “giving exposure to scientist reviewers and student scientists from other cultures and schools,” and “students presenting, collaborating with other students from around the state, they see their science matters.” In another comment emphasizing the importance of forging these connections, an educator appreciated “bringing the Jr. Scientists together where they can meet one another and make connections with their research—place-based meaning full.”

Nine comments referenced the opportunity for students to engage in a positive STEM learning experience. They described “the students’ success in participation,” “the opportunity for my students to show what they know about science,” and “listening to students share their authentic research conclusions and seeing the pride in their eyes along with teachers, family, and community members.”

Other comments referred to the activities at the events including drone building, pH testing, and a data jam (7), the event organization and location (4), and the keynote speaker (3).

Educators were also asked what was LEAST SUCCESSFUL about the events. Of 39 responses, 12 were a variation of “nothing,” for example, “you raised the bar very high for next time! I could not think of anything that was least successful,” “I don’t have anything – it’s been awesome!” and “Seriously? It was REAL extraordinary AWESOME EPIC.” Otherwise, comments were most frequently about the event organization and schedule (15). Specifics varied, with some educators finding the day too short and others too long or in need of more stretch breaks. Some wished there were more time for review or activities, reporting that things got cut short or students were not able to participate in all of the event offerings due to time constraints. One felt that the organization of the event happened too late, leaving inadequate time for preparation. In another two comments, educators said they would have liked more schools and more students to participate.

The remaining comments referenced the weather’s effect on outdoor activities (2) or were individual observations. For example, one educator commented that “travel planning was difficult. Communication concerning travel was unclear,” and another that “the least successful was the sign in/signage of the event, it was unclear if parents or guests could attend, and the size of the of the presentation room.” Some educators’ comments included suggestions for event improvements:<sup>9</sup>

*Nothing - if there was a way to force the kids to interact with each other - maybe pair older with younger students and have them do a protocol together. —Educator*

*Some more time and instruction opportunity, for practice and what was going to happen in the poster session and the expectations may have been helpful - especially for very 'green' students. —Educator*

*[Venue] - flow of meals, quality/amount of food ... and pre-arrival communication [could improve]. —Educator*

*For team spirit and to reduce waste, maybe an idea would be GLOBE Nalgene [reusable water bottles] that everyone uses throughout the conference. —Educator*

Finally, educators were given the option to tell us anything else about the events they would like. Almost all of the 26 responses were positive (24). They praised the events as “a wonderful collaboration and celebration of learning research, and conservation efforts,” “an eye opening and fantastic event with a great group of people,” and “the highlight of the year for myself and my students. Thank you SO much!” One educator expressed:

*Thank you! This was such an inspiring and supportive environment for nurturing young scientists. I loved how the adults very appropriately treated the students as legitimate scientists, framing all of the participants as learners and scientists, regardless of age or credentials. —Educator*

Similarly, another educator remarked that “the staff were amazing at including the students, using their names and seeking their opinions and ideas.” Two educators were already looking ahead to future events, musing that “small, local events are awesome! Next time would invite other schools, maybe, but just one or two, keep it small,” and another “I really hope this continues and becomes an annual event.”

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<sup>9</sup> These suggestions are drawn from multiple open-ended educator survey items to improve report flow.



## Reviewer Survey Results

This section reports the results of the reviewer survey conducted online by invitation via Qualtrics after each of the local SRS events. The reviewer survey was conducted for two primary purposes: 1) to collect reviewer information and feedback to improve the GLOBE SRS event experience for reviewers and inform reviewer recruitment and retention, and 2) to collect reviewer demographic information to assess the diversity of STEM professional representation at GLOBE SRS events. Event leads provided us with contact information for 50 reviewers and 25 (50%) completed the survey, at least one from each event. Please see [Appendix C](#) for more information. The results are presented in aggregate. Reviewer quotations from responses to open-ended questions are not identified by event title as there were not enough reviewers from every event to do so without presenting a risk to their privacy.

### Reviewer Information and Feedback

The reviewers who completed the survey held multiple roles, including professional or industry scientists (9), GLOBE Partners (4), and professors or faculty (4), and others (9), for example undergraduate and graduate students, event site personnel, and professional and volunteer positions. Most (88%) had never served as a GLOBE reviewer before, and over a third (39%) had never served as a reviewer for any K-12 science event. In general, reviewers were satisfied with their GLOBE SRS experience. They rated aspects of the experience on a scale of ‘very dissatisfied’ to ‘very satisfied’ (Figure 8). These ratings excluded two reviewers who were also members of the event teams.

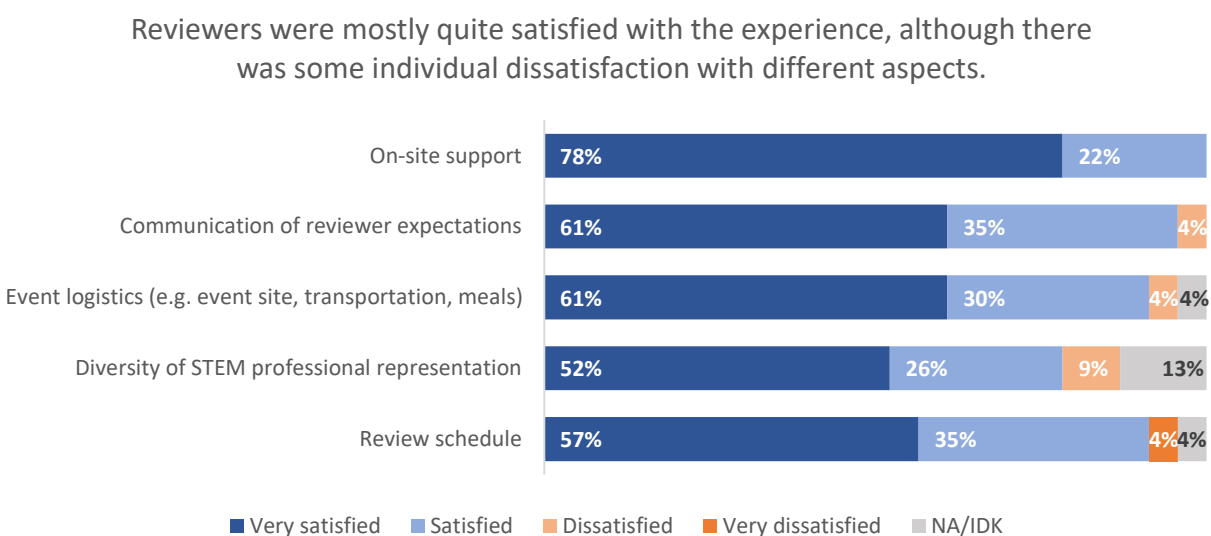


Figure 8. Reviewer satisfaction with aspects of their GLOBE experience (n=23).

On-site support had the highest average satisfaction rating. The average ratings for the remainder were similar at about the midpoint between ‘satisfied’ and ‘very satisfied.’ With the exception of on-site support, at least one (4%) of the 23 reviewers was dissatisfied with each aspect of the experience. Two (9%) were *dissatisfied* with diversity of STEM professional representation, and three (13%) responded “NA/I don’t know.” We asked reviewers for suggestions to improve their experience at GLOBE SRS events, and most of the suggestions they offered can be grouped into two main categories:

- **Reviewer preparation:** Advance communication of reviewer role, review process, expectations of reviewers and students, any information about the presentations.
- **Event schedule and organization:** Organized rotation system and flow, review assignments and timing to prevent double ups and delays, adequate time to complete all reviews.

Other suggestions included introductions, enough space to avoid crowding and noise, and “more room on the forms to comment on student engagement. I was so impressed with these young researchers.”

All (100%) of the reviewers participating in the survey were *very satisfied* (87%) or *satisfied* (13%) with the events as a science learning experience for students. Asked how the events could be improved as a learning experience for students, 14 reviewers responded. Eight responses indicated no suggestions to offer, praise for the events, or both, for example, “I think this is a fantastic experience for the students! I have no other suggestions at this time. Thank you for making this available to them!”

Six responses offered suggestions for improvement, three of which focused on student preparation for conducting and presenting on GLOBE research. For example, one suggested to “more clearly communicate to or better integrate non-host schools. I'm not sure if students outside of the host school were taught how to present their work within GLOBE's model.” Two others suggested:

*Please provide the students options on the tools they may use for their projects. Some of the GLOBE protocols were directly applicable for a project, while some were only tangentially related, some even required different tools to prove their main hypothesis (even some very simple tools). Options will broaden the possibilities of what students may choose to pursue for a project, based on their interests. —Reviewer*

*We could tell that the students worked hard on their projects ... not sure how they were instructed, since we only came in at the end as reviewers, but it looked like more guidance on how to pick a topic and focus on a clear objective would have been useful for some of them. Also, not all of them used appropriate tables and graphs. Their strongest points seemed to be understanding where future studies could go. —Reviewer*

One reviewer suggested introductions, and another suggested more opportunities to interact with the STEM professionals:

*Having a ‘Research Workshop’ following the fair where students have the opportunity to walk around and talk with other professional scientists about how professional research is conducted in the field. I believe that being exposed to the similarities between professional projects as a student researcher could help improve student confidence. —Reviewer*

Another reviewer reflected that “it would be nice to hear how they received this feedback and will incorporate it [in] the future.” Relatedly, in the suggestions for improving the experience for reviewers, one reviewer recalled, “I was given the project review forms, but they were never asked for or collected afterward—so it seems they were provided mostly for my personal notetaking. That was not made clear to me.” This indicates a specific need within the category of improving preparation for the review process to explain the purpose of the review forms.

Reviewers were also asked if there is anything that makes GLOBE events different from other science events for K-12 students in their experience. Among ten responses, four reviewers described the GLOBE

SRS as less competitive than traditional science fairs, acknowledging all students' contributions. One of these found the SRS "much more supportive," and another liked "that the focus is not on prizes/competition," also observing that the review form is "more comprehensive." Another explained:

*I appreciated that we gave out awards for each student poster rather than selecting only 'top award' categories and awarding those to a small subset of students. Giving everyone recognition for their unique contribution felt like a more constructive use of the awards. —Reviewer*

Three others lauded GLOBE's support for student engagement in science. One remarked that the "projects are based more on authentic science," and another that "students have a freedom to express their passion and dedication for STEM learning and their research with GLOBE." One reviewer focused on the relationship-, identity-, and community-building aspects of the experience:

*Modeling real conference relationship-building! So powerful! ... Youth definitely made comments that indicated at least some participants came away valuing and understanding relationships—with others, with self, with land—as part of doing science. —Reviewer*

One reviewer found that "GLOBE is less formal with less prescribed time for feedback to the students." Another commented that "I like that GLOBE provides protocols for students. It's a great way to teach methods while allowing students to focus on bigger picture aspects of their study." A third that had no other experiences to compare it to still noticed that "the GLOBE poster organization led the older students to 'fill in the blanks'; and present their data in a very organized way."

In their optional final comments, one reviewer expressed that they were expecting "a more formally organized event with give and take between the students and the professional representatives," and "more built-in opportunities to coach the students on their presentations," again linking back to the need for more reviewer information and preparation in advance of the events. The remaining six comments were all positive, such as "thank you for the opportunity to serve as a reviewer. It's been a great experience," "wonderful program. I hope to be involved in future events!" and "so glad to see events like this ... these young people are inheriting some huge problems, and good STEM education will hopefully lead them to findings solutions."

## Reviewer Demographics

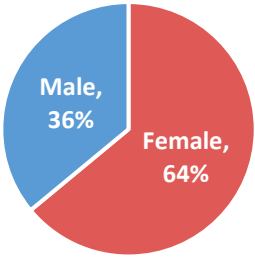
We collected demographic information in the reviewer survey to evaluate progress toward expanding diverse representation of STEM professionals at the GLOBE SRS. Demographic items included gender identities, racial and ethnic identities, and social identities and lived experiences.

Among those participating in the survey, about two-thirds identified their gender as female (64%) and about one-third as male (36%). Selecting as many racial and ethnic identities that applied, 76% selected White, 20% selected Asian, and a combined total of 24% selected Black or African American; Hispanic, Latino/a/x, or Spanish origin; Middle Eastern or North African; Native American or Alaskan Native; or 'other'.<sup>10</sup> Twenty percent selected multiple racial or ethnic identities. (Figures 9a & 9b.)

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<sup>10</sup> The results for categories with fewer than five selections were suppressed for participant privacy.

Reviewer Gender Identities  
(not mutually exclusive)



Reviewer Racial and Ethnic Identities  
(not mutually exclusive)

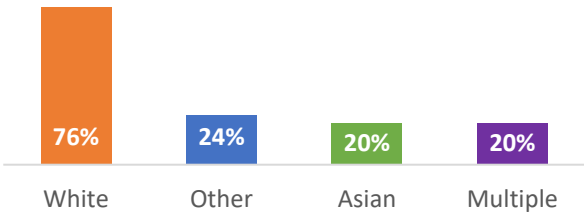


Figure 9a & 9b. Reviewer demographic information (n=23).

The social identities and lived experiences of reviewers included being in the first generation of their family to attend college; identifying as LGBTQA+, non-cisgendered, or non-binary; having English as their second language; being an immigrant to the U.S.; qualifying for free or reduced lunch at some point in their K-12 education; and living with a disability or identifying as a disabled person.

## Event Team Survey Results

Eighteen event team members were identified in the event proposals, and 14 (78%) participated in our Qualtrics event team feedback survey, including all event leads. The purpose of the survey was to learn about their experiences running the events and get their feedback to inform future programming. Event team members held multiple roles, including GLOBE Partner (9), event site personnel (6), K-12 educator (6), and STEM professional (5). Half of the event team members had attended a regional SRS in the past. Twelve of the fourteen would *definitely* attend the regional SRS next year if it were safe and the other two would *probably* attend.

Event team members were highly satisfied with GLOBE event supports, including response to requests for information and support, planning for the administration and return of student and educator surveys, help with planning for an inclusive and accessible event, and adequacy of the funds awarded. None were dissatisfied with any aspect. (Figure 10.)

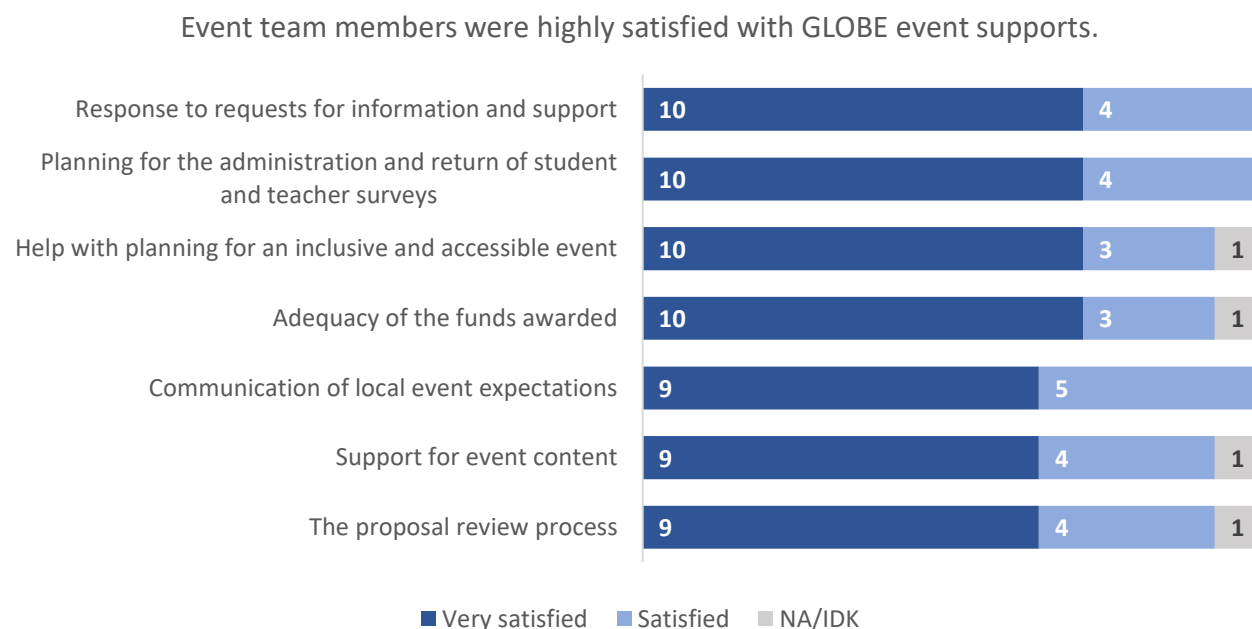


Figure 10. Event team member satisfaction with GLOBE event supports (n=14).

Most event team members believed that the local event met its objectives *completely* (10) and the rest *mostly* (4). Asked about the most successful aspect of the events, their responses focused on the student experience: on the opportunities the events offered students (5), student participation and engagement (6), student interactions with STEM professionals (5), and peer review (3). For example:

*Students from rural Indigenous villages who are off the road system had the opportunity to share their cultures and science investigations. They had fun meeting kids from across the state and felt respected and valued.* —Event Team Member

*Seeing how excited the students were after spending time with the reviewers. They were scared going in and were commenting about how nice the reviewers were, not scary at all. They*

*appreciated the feedback given. Big smiles all around. They were proud of what they accomplished!* —Event Team Member

*Students sharing their GLOBE research findings and listening to other students' presentations. The entire day was about celebrating their learning and citizen science efforts. It was amazing!* —Event Team Member

*The interactions between the students who were able to attend in person were stellar. The students from [the participating schools] were congenial, and the questions that were asked by students to the presenters were of a very high quality. [An educator] mentioned that she felt that her [middle school] students really benefited from seeing the presentations of the [high school] students, that it showed them what they could do in the future.* —Event Team Member

One event team member highlighted the diversity of STEM professional representation at the event and the opportunity to “rekindle a partnership” with the community organization that hosted it as successes. In other survey comments, an event team member concluded, “you know, even though it was a small event, I believe that the students that attended got a lot out of it.”

The biggest challenges reported by event team members included logistics (4) primarily related to travel (3), and chilly and windy weather outside (4). Scheduling events around school testing presented another challenge (2) and this contributed in at least one case to the related challenge of lower-than-expected participation of educators and students (4). Comments on this latter theme included:

*Having students attend in person this year was challenging. Last year ... teachers and students [in our state] participated in [a virtual symposium], and more students and teachers were able to participate. The date also conflicted with students studying for Advanced Placement exams.* —Event Team Member

*It was a struggle finding teachers/informal educators with the bandwidth to complete the process of completing a project with all the changes going on in the schools. I know the teachers were over-burdened. I made myself available, loaned equipment, interacted frequently with the teachers to answer questions, went to some of the sites with the students. Some even did their projects on our site via two field trips. It was a challenge, but well worth the result!* —Event Team Member

Nearly all would *definitely* (9) or *probably* (4) want to hold a local SRS event again next year, even if there were a regional SRS. Asked why, eight of the 10 responses focused on the value of the events for students and educators. Team members referred to the events as “important” and “meaningful” for the students, and one referred to themselves as “passionate about student research opportunities.” Some offered more detail in their reasons, for example, “it is worth it to see that spark of enthusiasm for science grow in students as well as for the educators and chaperones,” and “the students really benefited from this opportunity to receive feedback from both peers and STEM reviewers, and it also increased the teacher buy in to using the GLOBE protocols to collect data.” Others similarly expressed:

*... They are so worth doing. Getting students to undertake authentic scientific environmental projects is my ultimate goal for GLOBE students! I would be open to hosting a regional SRS. ... The mini-SRS got our fingers wet!* —Event Team Member

*My students enjoy traveling and sharing what they have learned. I am always in support of promoting science and celebrating student success in science. Students who enjoy science should receive as many opportunities as possible to encourage additional exploration.*

—Event Team Member

*They are an amazing chance for our youth to connect. [It] was sooooo powerful for the kids to see how the data they collect in their location compares and relates to the same data being collected with the same protocols in other communities.* —Event Team Member

The remaining two responses suggested a desire to hold the events again, but some hesitation based on future availability and resources. One event team member said they wanted to hold an SRS again, “but I don't want to coordinate it. Need to pass the torch...” and another reported with uncertainty, “the youth and educators want to come back next year, which is wonderful. I don't know if we'll have the funds to support travel for so many communities.”

Asked what they would do differently next time, about half of the team members would change the venue, some to move it indoors (4), some for logistical and scheduling reasons (2), and one just to rotate the location (1). Two would change the agenda to allow more time for the keynote speaker (1) or add break time (1), the latter in addition to changing from a plated lunch to a bagged lunch. Two would engage in more and earlier event promotion to increase participation, while one would be prepared for higher-than-expected attendance based on registration. Finally, one would encourage educators and students to get their projects started earlier in the school year and use GLOBE resources:

*Start at the beginning of the school year, like right now! Use the webinars and resources more fully on the website, make myself available to the teachers as needed. We just had a GLOBE workshop two weeks ago and one of the teachers said she loved the template for the poster as it helped her to work through the writing process with the students. She said she was close to having her students submit their work for this year's symposium but is really excited about starting early and entering this year!* —Event Team Member

In optional final comments, one event team member also suggested a regional virtual event:

*It would be great to have a GLOBE data entry and poster upload event over Zoom in our time zone ... Some teachers need a lot of support with digital tools. Motivation (e.g., door prizes, GLOBE supplies, Davis weather station tech support) would help!* —Event Team Member

The remainder of the four optional final comments submitted expressed gratitude for the opportunity. One remarked “thank you for everything!” and others added:

*I appreciate having the opportunity to hold the mini-SRS this year. It has initiated interest and a larger group of teachers are now interested in having their students complete GLOBE projects in the coming year!* —Event Team Member

*Thank you for your help and support (funds and moral support). We appreciate and are grateful to Jen Bourgeault's (the U.S. Country Coordinator's) out-of-the-box thinking that enabled us to make it work at the local SRS we conducted.* —Event Team Member

## Value of the Local and Regional SRS

In order for this evaluation to inform GLOBE programming decisions, it is important not only to consider the outcomes of the local SRS events but also to understand how those outcomes compare to the regional SRS. A true ‘apples to apples’ comparison is difficult for a couple of reasons, including different methods of measuring change in students’ science skills, interest, and self-efficacy, and the inability of participants who had not previously attended a regional SRS to compare the events. Nevertheless, the comparisons we were able to make with the available data were worth exploring with those caveats.

### Student Outcomes

At the last regional SRS in 2019, we conducted pre-test and post-test student surveys to assess change. The surveys included a measure of science skills, interest, and self-efficacy with 17 statements and a scale of agreement from 1 ‘strongly disagree’ to 6 ‘strongly agree.’ For the 2022 local SRS, we conducted a brief post-test survey only due to time constraints and used the retrospective pre-post method, asking students to look back on their beliefs before and after the event to rate their agreement. We used eight of the 17 statements based on either evidence of significant change at the regional SRS or relevance to key information needs for this evaluation, and added a new statement about GLOBE affiliation.

Although we employed the retrospective pre-post method for practical reasons it may offer other advantages too. Sometimes people overestimate their knowledge and skills before a learning experience, which can suppress the change between pre-test and post-test or cause a ‘ceiling effect’ leaving little room for improvement over time. The retrospective pre-post method allows them to compare their positions before and after the event with an updated frame of reference based on what they learned and experienced to make more accurate assessments (Allen & Nimon, 2007). Additionally, the local SRS event student surveys were anonymous, while the regional SRS student surveys were identified with their registration badge numbers. Therefore, the local SRS students may have been more candid with their responses. There were also no cases lost in the analysis due to our inability to match pre-post survey data if badge numbers were missing or if students missed one of the two survey administrations. With these limitations for drawing direct comparisons in mind, we found that 1) average pre-test agreement scores were lower for every statement in the local SRS surveys compared with the regional SRS surveys, and 2) change in average agreement was greater for the local SRS compared with the regional SRS. (Figures 11 and 12).

The difference in measurement methods may be partly or entirely responsible for these differences. Alternatively, or additionally, it is possible that the local SRS were easier for students to access and therefore brought in students with a broader range of science engagement backgrounds at the start. GLOBE does a lot to make sure the regional SRS are accessible to everyone, including providing scholarships. But the local events may have been easier to attend for younger students, students with barriers to traveling, or students who just wanted to go on a science field trip with their classmates or group. This may partially explain the difference in local SRS student pre-test scores compared to students who, sometimes with their families, made the substantial effort to travel to a regional SRS.

Notably though, the regional SRS had different outcomes for different students. For example, students from lower income households showed a greater increase in their agreement between pre-test and post-test, narrowing the gap between income groups. These larger changes among higher-need students are somewhat hidden within the overall regional SRS results in this comparison.



Results showed lower pre-test scores and greater positive change in agreement with statements about science skills and self-efficacy for the local SRS (retrospective) compared to the the regional SRS (pre-post).

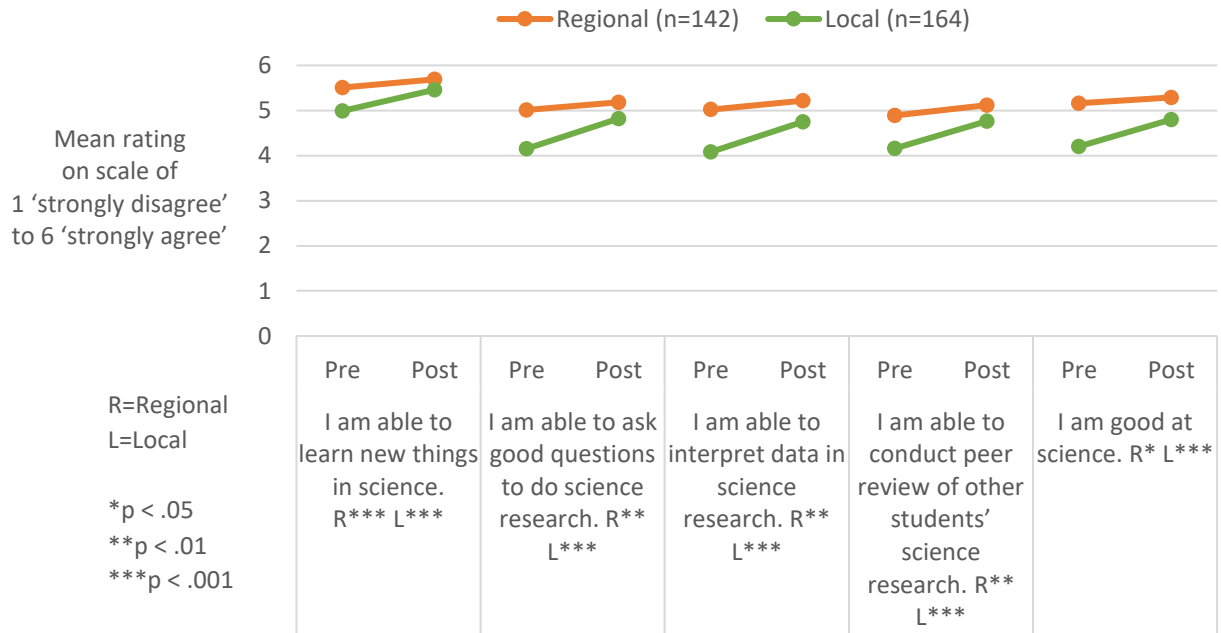


Figure 11. Comparison of student pre-post agreement with statements about science skills and self-efficacy between the local and regional SRS using different methods of measurement.

Results showed lower pre-test scores and greater positive change in enjoyment of and pride in science and interest in a science career for the local SRS (retrospective) compared to the regional SRS (pre-post).

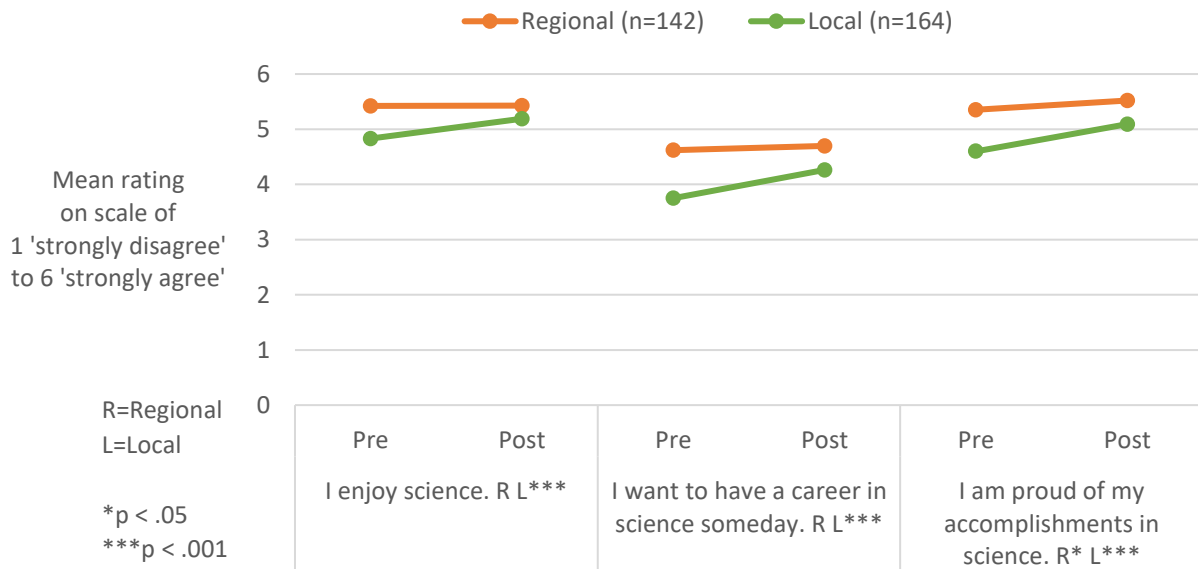


Figure 12. Comparison of student pre-post agreement with statements about enjoyment of and pride in science and interest in a science career between the local and regional SRS using different methods of measurement.

Event team members who had previously attended a regional SRS commented on these differences between the local and regional events, with two supporting broader student access at the local events:

*This was larger than any [of this region's] SRS has been, EVER! It was also amazing and more successful than if we had been able to do a [regional] symposium outside of [our state]. ... I think having it at a statewide level really helped us recruit our GLOBE teams better and made the logistics for the teachers and families easier than if they had to travel out of state. It also made the costs more realistic and manageable for rural ... travelers. I think we should do [a statewide event] every two or three years. —Event Team Member*

*The event was PERFECT for young researchers ... I'm not sure I would take them to a regular SRS ... The venue was perfect to support first time research ... we are hoping to expand this event and invite more schools doing GLOBE ... research next year! —Event Team Member*

### Geographical Coverage

Using registration data from the 2019 regional SRS records and student and school data from the 2022 local SRS event reports, we were able to map student participation by state. (Figures 13a & 13b.) Total student participation was 25% higher for the six regional SRS than the seven local SRS events (261 compared with 212) but represented more than four times as many states (22 compared with 5). This is almost certainly due in large part to the intentional planning of the regional SRS to cover all areas of the country. Although there was a geographical criterion in the proposal review process for the local SRS, it was not applied to the funding decisions at least in this first experimental phase. The maps also point to the strength of the local SRS to reach more students in relatively remote states, namely Alaska in this round, and the strength of the regional SRS to convene a wider distribution of states.

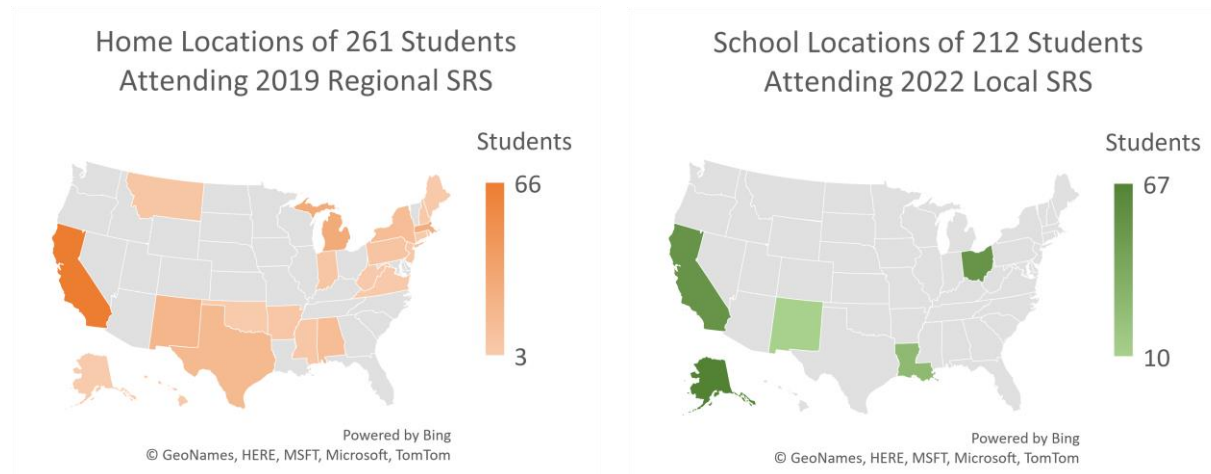


Figure 13a & 13b. Comparison of student participation by state in the 2019 regional SRS (left) and 2022 local SRS (right).

A local event team member who had previously attended a regional SRS commented on the benefits of the greater geographic diversity of students:

*I saw it as a bridge to the next [regional] SRS. I did not want another year to pass without a symposium opportunity for the local students. ... Regional symposia, although more work, allow students to visit a site they may never have had the opportunity to visit and share ideas with a more diverse group of presenters. ... They can share their home cultures and environmental*

*issues with each other, broadening their perspectives of the world. It bridged that gap in that we have a set of teachers who have the experience of a symposium and are more likely to continue managing student projects and will share the experience with their network of teachers.* —Event Team Member

Again, this speaks to the distinct strengths of the local and regional events. The regional events offer students more novel experiences, locations, and activities. They also bring together students from diverse communities with diverse experiences and ideas to share, and better approximate the experience of a national academic conference. The local events introduce students to local ecosystems and science resources in their home communities. They can also be more responsive to local cultures and ways of knowing. For example, the Alaska GLOBE SRS team developed a modified project review form that considers Native Alaskan indigenous knowledge and connection to Elders. Comments from several students at the Alaska GLOBE SRS show that they appreciated the event’s connections to their communities and cultures, reflecting that “I liked the kk’eeyh birch green up best because I am Athabascan,” “I liked when we talked about Koyukon because I’m Yup’ik and Koyukun,” and “maybe it is cool to talk about our tiny awesome village.”

## Key Findings & Recommendations

The 2022 local SRS events were initially envisioned as a stopgap measure to offer students and educators a safer alternative to the regional SRS during the COVID-19 pandemic. Program leadership did not know what GLOBE U.S. Partners might propose for the events—what venues they might use, what activities they would plan, or how they would manage the logistics. Once the proposals gave the events more shape, it was still hard to predict how many students and educators might participate. As shown in this report, the local SRS events offered a wide range of activities for the 212 students and 37 educators who showed up. These participation numbers exceeded the expectations of program leadership. Event reports and participant feedback indicate that the events were well executed, and that nearly all educators and reviewers would like to participate in GLOBE SRS events in the future. And perhaps most importantly, the student outcomes were at least as positive for the local events as the regional.

We close with key findings and recommendations from the evaluation.

**KEY FINDING: Local SRS events reached underserved communities.** Fifty-four percent of students and 52% of teachers participating in the events came from schools where a majority of students were identified as economically disadvantaged. Forty-five percent of students and 55% of teachers participating came from schools where a majority of students were identified as a race or ethnicity underrepresented in STEM, specifically Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native.

**RECOMMENDATION: The financial support of GLOBE sponsors helps to cover scholarships, transportation, and other costs that can be a barrier to participation for the local and regional SRS.** Continuing this sponsorship is critical to supporting GLOBE U.S. Partner efforts to broaden participation. The local SRS events in particular may have been more accessible to students who have barriers to travel. We will evaluate this further in 2023 by collecting comparable school data for the regional SRS. Additionally, we will seek to evaluate the inclusiveness of the events—in other words, what happens after students from underrepresented communities walk through the doors.

**KEY FINDING: Student survey results show significant positive change in agreement from before to after the events on every statement in our self-report measure of science skills, interest, and self-efficacy, and GLOBE affiliation.** In their own words, 86% of responding students described a positive change in their attitude towards science, the SRS, or related experiences. Many found the SRS more fun or interesting than expected, found presenting to STEM professionals less stressful than anticipated, felt more confident and capable of participating in science, and enjoyed learning new things in science.

**RECOMMENDATION: This evidence of the SRS model’s effectiveness for increasing student engagement in STEM warrants continuation and expansion of the events.** Continue supporting the SRS, as well as efforts to broaden participation and address financial and logistical barriers so that more students can benefit from the opportunity.

**KEY FINDING: Most students reported that they felt happy, excited, and focused during the events.** They frequently reported enjoying the various activities at the events the most, such as going to the zoo and aquarium to see animals, building and playing games with drones, and going to a local body of water to learn about crabs. They also enjoyed presenting and getting feedback on their research.

**RECOMMENDATION:** In addition to the required SRS components of the presentation and review, include activities that offer the opportunity for students to get up, get outside and have fun with their learning. Students enjoy the SRS overall but seem to find this type of activity especially engaging.

**KEY FINDING:** Our comparative analysis of events showed that career talks made a significant difference in the influence of the events on student interest in a science career, and that students who attended off campus events had significantly higher GLOBE affiliation before and after the events. Overall, however, it is not clear that off campus events are inherently more effective. A possible explanation is that novel elements differentiating the events from a typical school day increase engagement and improve outcomes, and going to a new location is one example of a novel element.

**RECOMMENDATION:** Include a career talk in future events. Incorporate novel elements such as new locations, activities, or people (students from other schools, GLOBE Partners or event site personnel as activity leaders, guest speakers). For school events, even holding the event in a different part of the school outside of the classroom, like the library, gym, or auditorium may offer some benefit.

**KEY FINDING:** All of the educators were satisfied with the events as a learning experience for students, and all would definitely or probably attend a GLOBE SRS event in the future. They found the presentation and review and opportunities for students to authentically engage in science within and across communities the most successful aspects of the events. Eighty-one percent of educators who completed our survey had never attended a GLOBE SRS before, suggesting the local events were successful at reaching new GLOBE participants.

**RECOMMENDATION:** Continue efforts to engage educators in the SRS. The local SRS events may help to expand the GLOBE community by getting new educators involved.

**KEY FINDING:** Ninety-eight percent of educators reported that participating in the events improved their ability to integrate science research in their classroom or program, and most educators found the GLOBE resources they used prior to the event helpful for their science teaching. This was especially so for consultation/support from their local GLOBE partnership, the science practices resource pages, and mentorship with a STEM professional from the GISN. Less than a third reported using the GLOBE Watercoolers and educator blog posts.

**RECOMMENDATION:** Solicit additional educator feedback on the current resources available and other resource needs. Promote the educator resources to build awareness. Educators mostly find the GLOBE resources they use helpful, but there is room for improvement and increased uptake in this area.

**KEY FINDING:** All reviewers who participated in our survey were satisfied with the SRS events as a learning experience for students, observing that they were less competitive and more supportive of student engagement than other K-12 science events. They were also mostly satisfied with their own experience at the events, especially the on-site support. However, there was some individual dissatisfaction with different aspects, including communication of reviewer expectations, the review schedule, and diversity of STEM professional representation. A combined total of 24% of reviewers reported their racial or ethnic identities as Black or African American; Hispanic, Latino/a/x, or Spanish origin; Middle Eastern or North African; Native American or Alaskan Native; or 'other.' Most of the reviewers who completed our survey had never served as GLOBE reviewers before, again suggesting the reach of local events to new participants.

**RECOMMENDATION: Prepare reviewers in advance of events and plan a review schedule to keep things flowing smoothly. Continue efforts to engage Black or African American, Hispanic or Latino/a/x, and Native American or Alaskan Native reviewers to improve STEM professional representation for students.** Advance preparation and organization can improve the experience of reviewers at GLOBE events. This can be important for attracting and retaining reviewers. Also, we know students benefit from seeing scientists who look like them. The diversity of STEM professional representation is an area for improvement according to the demographic data collected and some reviewer feedback.

**KEY FINDING: The event team members who completed our survey were highly satisfied with GLOBE event supports and reported that the events completely or mostly met their objectives. Nearly all wanted to hold a local SRS event again next year, even if there were a regional SRS.** Among the GLOBE supports, they were especially satisfied with the response to requests for information and support, planning for the administration and return of student and educator surveys, help with planning for an inclusive and accessible event, and adequacy of the funds awarded. They found the most successful aspects of the events were the opportunities they offered to students, their participation and engagement, interactions with STEM professionals, and the peer review.

**RECOMMENDATION: Event team member feedback suggests the local events are viable and there is enthusiasm to hold them again.** There is willingness to continue or repeat local events if GLOBE leadership should choose to support the option again in the future. The funding and other assistance offered by GLOBE this year appears to have been sufficient to support successful events.

**KEY FINDING: Both the local and regional SRS have shown evidence of positive outcomes for student self-reported science skills, interest, and self-efficacy, and each offers unique value for GLOBE U.S. programming.** We cannot draw conclusions about how student outcomes compare because they were evaluated using different methods. However, we do know that the regional events convene students from a wider distribution of U.S. states. Therefore, they presumably include students with more diverse experiences and ideas to share, and are more likely to offer students novel locations, activities, and experiences. The local events introduce students to ecosystems and science resources in their own communities, and they can be more responsive to community cultures and values. They may also be more easily accessible, especially for younger students, students in remote areas, and students with barriers to traveling long distances for a weekend-long regional SRS. As a result of being more accessible, they may bring new students, educators, and reviewers into the GLOBE community.

**RECOMMENDATION: Consider opportunities for local SRS events to complement—not duplicate—regional SRS going forward.** Focus on how they can reach students, educators, and reviewers who may have barriers to participation in the regional SRS, or who may want to try out a local SRS before making the more substantial investment to attend a regional SRS. Reflect these priorities in the request for proposals and proposal review process to ensure resources are going where they are needed most. Allow the local events to develop and pilot test culturally responsive modifications to the SRS model to better serve their communities and offer guidance for other GLOBE communities or for GLOBE U.S. programs more broadly.

In summary, the local SRS events were successful and enjoyable for participants. They showed evidence of positive outcomes for students and educators. The findings in this report suggest a role for local SRS events in the future beyond pandemic risk management. Rather than detracting from the regional SRS, they may potentially do the opposite, increasing participation in the regional SRS and other GLOBE U.S.

programming by bringing new members into the GLOBE community. We will continue conducting evaluations on the regional and local SRS events to better understand their relationships and impact.

## Acknowledgements

The author would like to thank NASA and YLACES; Jen Bourgeault and Haley Wicklein at the U.S. GLOBE Coordination Office; the local SRS event leaders, team members, and reviewers; and participating educators and students for their support and contributions to this evaluation project.

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## Appendix A: Student Post-Event Survey

### GLOBE 2022 Student Event Post-Survey

This survey will help us understand how GLOBE events are helping students like you learn and become better at science. You may skip any questions you do not want to answer or cannot answer. If you have a question, ask your event leader or teacher to help you. **Please do NOT write your name on this survey.**

<b>1. <u>DURING</u> this event:</b>	<b>Circle <u>one</u> response for each sentence.</b>			
I felt bored.	NO!	No	Yes	YES!
I felt happy.	NO!	No	Yes	YES!
I felt excited.	NO!	No	Yes	YES!
I was daydreaming a lot.	NO!	No	Yes	YES!
I was focused on the activities we were doing most of the time.	NO!	No	Yes	YES!
Time went by quickly.	NO!	No	Yes	YES!
I talked to others about stuff not related to what we were learning.	NO!	No	Yes	YES!

**2. What did you ENJOY MOST about this event?**

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**3. What did you ENJOY LEAST about this event?**

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These items ask you to think about how well you are able to do science and how much you like and value science. Please circle the response below that most closely matches your beliefs about science, in particular Earth Science, BEFORE and AFTER this GLOBE event.

<b>Key:</b> 1 = Strongly disagree    4 = Agree a little 2 = Disagree                      5 = Agree 3 = Disagree a little        6 = Strongly agree	<b>Circle <u>one</u> response from 1 to 6 for each sentence.</b>					
<b>4. <u>BEFORE</u> this event, I believed that:</b>	Strongly Disagree ←————→ Strongly Agree					
I am able to learn new things in science.	1	2	3	4	5	6
I am able to ask good questions to do science research.	1	2	3	4	5	6
I am able to interpret data in science research.	1	2	3	4	5	6
I am able to conduct peer review of other students' science research.	1	2	3	4	5	6
I am good at science.	1	2	3	4	5	6
I enjoy science.	1	2	3	4	5	6
I want to have a career in science someday.	1	2	3	4	5	6
I am proud of my accomplishments in science.	1	2	3	4	5	6
I am a member of GLOBE.	1	2	3	4	5	6
<b>5. <u>AFTER</u> this event, I believe that:</b>	Strongly Disagree ←————→ Strongly Agree					
I am able to learn new things in science.	1	2	3	4	5	6
I am able to ask good questions to do science research.	1	2	3	4	5	6
I am able to interpret data in science research.	1	2	3	4	5	6
I am able to conduct peer review of other students' science research.	1	2	3	4	5	6
I am good at science.	1	2	3	4	5	6
I enjoy science.	1	2	3	4	5	6
I want to have a career in science someday.	1	2	3	4	5	6
I am proud of my accomplishments in science.	1	2	3	4	5	6
I am a member of GLOBE.	1	2	3	4	5	6

**6. Before this event I thought:**

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**But now I know:**

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**7. OPTIONAL: Is there anything else you would like to tell us about this event?**

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**THANK YOU FOR PARTICIPATING!**

**Please return this survey to the event leader or your teacher.**

## Appendix B: Educator Post-Event Survey

### GLOBE 2022 Teacher Event Post-Survey

This survey will give us feedback about this GLOBE local event and help us understand how GLOBE is helping teachers facilitate science learning among their students. You may skip any questions you do not want to answer or cannot answer. If you have a question, ask an event leader to help you. **Please do NOT write your name on this survey.**

1. Did your students present research at this event?

- Yes                       No

2. Overall, how satisfied were you with this GLOBE local event as a science learning experience for the students?

- Very satisfied  
 Satisfied  
 Dissatisfied  
 Very dissatisfied

3. In your opinion, what was the **most successful** part of this event?

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4. In your opinion, what was the **least successful** part of this event?

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5. Did participating in this event improve your ability to integrate science research in your classroom or program?

- Yes                       No

**6.** What grade(s)/subject(s) do you teach your students who attended the event?  
(Write in "N/A" if you did not bring students to the event.)

---

**7. OPTIONAL:** Is there anything else you would like to tell us about this event?

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**8.** If there were a GLOBE local event held next year, would you attend?

- Definitely would attend
- Probably would attend
- Probably would not attend
- Definitely would not attend
- Don't know

**9.** Have you ever attended a GLOBE Student Research Symposium (SRS)?

- Yes
- No

**10.** If it were safe to hold the SRS next year, would you attend?

- Definitely would attend
- Probably would attend
- Probably would not attend
- Definitely would not attend
- Don't know

- 11.** For each GLOBE resource you used prior to this event, please rate how helpful it was for your science teaching. If you did not use the resource, select NA.

Key: 0 = Not at all helpful    2 = Helpful 1 = Somewhat helpful    3 = Very helpful	Circle <u>one</u> response for each resource.				
GLOBE Resources	Not at all helpful ←————→ Very helpful				NA
Consultation/support from your local GLOBE partnership	0	1	2	3	NA
GLOBE Watercoolers	0	1	2	3	NA
Teacher blog posts	0	1	2	3	NA
Science practices resource pages (located on internal GLOBE webpages)	0	1	2	3	NA
Mentorship with a STEM professional from the GLOBE International STEM network	0	1	2	3	NA
<b>Write in others (optional):</b>					
1.	0	1	2	3	NA
2.	0	1	2	3	NA
3.	0	1	2	3	NA

**THANK YOU FOR PARTICIPATING!**  
**Please return this survey to an event team member.**

## Appendix C: Methods Supplement

This appendix provides additional details on the student, educator, event team, and reviewer surveys. Please contact [leanor.jaffee@insightsevaluation.com](mailto:leanor.jaffee@insightsevaluation.com) if you have questions about the evaluation instruments, methods, or reporting.

### Student Survey

The student survey included items from the GLOBE U.S. regional SRS pre-test and post-test surveys. These surveys were originally developed by GLOBE U.S. Coordination Office staff in 2016. Significant changes were made in 2017 to focus more on science self-efficacy, and the 2017 version remained in use through the most recent pre-pandemic regional SRS in 2019 with minor modifications. References for the supporting literature used in their development can be found in Appendix G.

For the regional SRS, a self-report measure of science skills, interest, and self-efficacy asked students to rate their agreement with a series of 17 statements at pre-test and post-test to assess change between administrations. However, the regional SRS are a full weekend long. The local events ranged in duration from a single class period to one full day. Furthermore, GLOBE U.S. Coordination Office staff were not going to be present at the local events to conduct or oversee data collection. We did not consider it feasible to ask event teams to administer a pre-test and a post-test in such a short time period. (Read more about [survey administration](#) below.)

For these reasons the student survey for local events was post-only. We used a selection of eight statements from the regional SRS science skills, interest, and self-efficacy measure for a retrospective pre-post measure, asking students at post-test only to rate the extent of their agreement before and after the event. Although we employed the retrospective pre-post method for practical reasons it may offer other advantages. People may overestimate their knowledge and skills before a learning experience, which suppresses change between pre-test and post-test. The retrospective pre-post allows them to compare their positions before and after the event using a new frame of reference for more accurate assessment (Allen & Nimon, 2007). It also ensures matched pre-post survey data for analysis. We will continue to evaluate this method using the current data and data we collect in the future.

The eight statements were selected based on evidence of significant outcomes at the 2019 regional SRS and importance to the current evaluation. We also added a new statement to the pre-post measure to assess GLOBE affiliation ('I am a member of GLOBE') and may use this statement in future regional SRS surveys. Internal consistency for the revised measure was good with a Chronbach's Alpha of .866 pre-test and .861 post-test. On a primary factor explaining approximately 45% of variance, factor loadings were greater than .600 for all pre-test statements except 'I want to have a career in science someday' and 'I am a member of GLOBE,' which were still above .500. Post-test factor loadings were greater than .600 for all items except 'I am able to conduct peer review of other students' science research' which fell to .504 and 'I am a member of GLOBE' which fell to .382. This suggests that these two statements, particularly 'I am a member of GLOBE,' track differently from the other statements pre-test to post-test.

In addition to items from the regional SRS pre-post survey, we incorporated selected items from the [Science Learning Activation Lab](#) engagement survey (Chung et al., 2016). This survey measures behavioral, cognitive, and affective engagement in formal or informal science learning activities and is geared toward students 10-14 years of age. Analysis of the results offers formative feedback about students' experiences of activities. Internal consistency was marginally good with a Chronbach's Alpha

of .680. The lowest factor loadings were for two of the recoded negatively worded items, ‘during this event I was daydreaming a lot’ at .454 and ‘during this event I talked to others about stuff not related to what we learning,’ at .210. Younger students or students for whom English is not their first language may have had difficulty interpreting these items, and we will reconsider their use in future surveys.

The student post-survey incorporated an open-ended item from the regional SRS post-survey in which students complete the statement, “BEFORE this event, I thought ... but NOW I know ...” We also asked students what they liked most and least about the events in open-ended questions.

### Educator Survey

The educator survey included selected items from the 2019 regional SRS post-only educator survey developed by GLOBE U.S. Coordination Office staff to assess the impact of participation on science pedagogy and educator use of GLOBE resources. Additional items were adapted or created to address satisfaction with the event and plans to attend future local or regional SRS. The wording of a new question, ‘if it were safe to hold the SRS next year, would you attend?’ referred to the regional SRS, but it may have been interpreted by participants as either local or regional—it was developed prior to learning that the local events would also be called SRS. This item will be revised if used in future surveys.

### Student and Educator Survey Administration

The anonymous paper-and-pencil student ([Appendix A](#)) and educator ([Appendix B](#)) surveys were administered by event team members on-site at the end of the events. The GLOBE U.S. Coordination Office mailed color copies of the surveys to event leads based on the anticipated numbers of participating students and educators along with instructions for survey administration and return ([Appendix F](#)) and prepaid shipping envelopes to send completed surveys directly to the external evaluator. In total 164 student surveys and 42 educator surveys were received this way. (Table 3.)

Table 3. Student and educator attendance and survey response rates by event.

Event	STUDENTS			EDUCATORS		
	Attended	Surveys	Response	Attended	Surveys	Response
GLOBE Alaska SRS	67	48	72%	19	21	111%
St. Peter’s Science GLOBE Symposium	7	7	100%	1	5	500%
New Mexico GLOBE SRS	10	8	80%	4	4	100%
Family Night at the Museum with GLOBE	33	28	85%	3	3	100%
Elkhorn Slough Reserve GLOBE SRS	21	17	81%	4	5	125%
Greater New Orleans GLOBE Science Symposium	27	15	56%	3	2	67%
Project Prairie & GLOBE SRS	47	41	87%	3	2	67%
<b>TOTAL</b>	<b>212</b>	<b>164</b>	<b>77%</b>	<b>37</b>	<b>42</b>	<b>114%</b>

The attendance numbers in Table 3 are from the event reports submitted by event leads to the GLOBE U.S. Coordination Office. The **red font percentages** show that more educators completed the anonymous paper-and-pencil survey than were reported to have attended the events. Survey responses and comments suggest that some attending educators who were not participating in GLOBE research, such as those serving as event chaperones, also completed the survey. For example, only 36 of the 42 educators completing the paper survey reported they had students presenting research at the event.

Educators who were also event team members were instructed not to complete the paper-and-pencil surveys. Instead, they were displayed additional items as part of the event team survey administered

online after the events via Qualtrics invitation. It is possible that some dual role event team members and educators took the anonymous paper-and-pencil survey at the events along with other educators and completed the Qualtrics survey items as well in an oversight contrary to the instructions. An additional six event team members submitted responses to the educator items, increasing the total educator surveys to 48. These team members were included among the 37 educators counted in the event reports and all reported they had students presenting research at the events.

As the paper-and-pencil survey was anonymous there is no way to reconcile the overcount by excluding non-participating educators and duplicate cases across the paper and Qualtrics surveys. For this reason, all the paper-and-pencil surveys were included in the analysis, and responses to the educator items in the Qualtrics survey were entirely excluded. The rest of the responses for these cases were retained as part of the event team survey dataset. In the future we will employ a different approach to the issue of on-site data collection for multiple roles.

Paper-and-pencil surveys received by the evaluator were entered into Qualtrics to create an electronic dataset for analysis. Data quality assurance measures included field validation, response requirements, and a 25% data entry case recheck.

### Event Team and Reviewer Surveys

Both the event team and reviewer surveys were new instruments developed for the local SRS events. The survey items were developed collaboratively by the external evaluator and U.S. GLOBE Coordination Office staff. The event team survey was intended to yield formative feedback about GLOBE support for the events and their successes and challenges. It also explored the value of the local events both in the context of these pandemic years without the regional SRS and looking forward. The reviewer survey sought information about reviewer preparation for and satisfaction with the SRS, and the reviewer perspective on the differences between GLOBE and more traditional science fairs. It also included demographic items to help understand the representation of STEM professionals at GLOBE SRS.

Although these two surveys were developed for the local SRS, they may have potential for additional administrations and further learning at future regional SRS.

### Event Team and Reviewers Survey Administration

Event team member and reviewer surveys were administered via Qualtrics. (Table 4.) Survey panels were established using the event team contact information provided in the event proposals, and invitations were scheduled to go out within a day of each event. A challenge of this approach was that many of the event reviewers were not identified and confirmed at the proposal stage. The contact information for reviewers was solicited from event team leaders via email by U.S. GLOBE Coordination Office staff right up to and even after the event dates. Two event team members who also served as reviewers were displayed additional reviewer items as part of the event team survey. Items presenting a conflict of interest, such as satisfaction with various aspects of the event, were omitted.



Table 4. Event team and reviewer attendance and survey response rates by event.

Event	EVENT TEAM MEMBERS			REVIEWERS		
	Attended	Surveys	Response	Attended	Surveys	Response
GLOBE Alaska SRS	4	3	75%	11	7	64%
St. Peter's Science GLOBE Symposium	1	1	100%	5	2	40%
New Mexico GLOBE SRS	2	2	100%	3	1	33%
Family Night at the Museum with GLOBE	1	1	100%	15	7	47%
Elkhorn Slough Reserve GLOBE SRS	2	1	50%	3	2	67%
Greater New Orleans GLOBE Science Symposium	4	2	50%	8	2	25%
Project Prairie & GLOBE SRS	4	4	100%	5	4	80%
<b>TOTAL</b>	<b>18</b>	<b>14</b>	<b>78%</b>	<b>50</b>	<b>25</b>	<b>50%</b>

### Survey Data Analysis

Quantitative survey data were analyzed using IBM SPSS and visualized using Microsoft Excel. Analyses were primarily descriptive. One exception was the longitudinal analysis of the student retrospective pre-post measure of science skills, interest, and self-efficacy using paired-samples t-tests. With the student sample size of 164, statistical power was sufficient (.817) to detect even a small effect (Cohen's  $d = .200$  or higher) in a one-sided test at a significance level of  $p < .05$ . T-test results were confirmed with the nonparametric equivalent for related samples, the Wilcoxon Signed Rank test, due to violations of certain t-test assumptions (random samples, and continuous and normally distributed variables). All results were upheld. Another exception was the comparative analyses based on event characteristics. Statistical power was lower for these tests as the sample was broken down by event and other conditions. Statistical test tables for all reported results can be viewed in [Appendix E](#).

Qualitative analysis of responses to open-ended questions was conducted using NVivo for the student and educator surveys to manage, code, and query the larger volume of qualitative data, and in Excel for the event team and reviewer surveys. Thematic code development used both deductive and inductive methods, guided by our 2022 evaluation questions and the 2019 regional SRS qualitative analyses, while also allowing new themes to emerge from the participant responses.

## Appendix D: Event Activities and Participation

Table 5. Event activities.

Event	STEM Professional Review	Peer Review	Meeting STEM Professionals	Meeting Other Students
GLOBE Alaska SRS	✓	✓	✓	✓
St. Peter's Science GLOBE Symposium	✓	✓	✓	
New Mexico GLOBE SRS	✓	✓	✓	✓
Family Night at the Museum with GLOBE	✓	✓	✓	✓
Elkhorn Slough Reserve GLOBE SRS	✓	✓	✓	✓
Greater New Orleans GLOBE Science Symposium	✓	✓	✓	✓
Project Prairie & GLOBE SRS	✓	✓	✓	✓
<b>TOTAL</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>6</b>

Table 6. Event activities (continued).

Event	Opening Remarks	Hands On Activities	Keynote Speaker	Career Talk	Closing Ceremony
GLOBE Alaska SRS	✓	✓	✓		✓
St. Peter's Science GLOBE Symposium					
New Mexico GLOBE SRS	✓	✓	✓	✓	
Family Night at the Museum with GLOBE	✓			✓	
Elkhorn Slough Reserve GLOBE SRS	✓	✓	✓	✓	✓
Greater New Orleans GLOBE Science Symposium	✓	✓			✓
Project Prairie & GLOBE SRS	✓	✓	✓	✓	✓
<b>TOTAL</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>4</b>

Table 7. Event participation.

Event	Schools	Students	Educators	Projects	Reviewers
GLOBE Alaska SRS	17	67	19	25	11
St. Peter's Science GLOBE Symposium	1	7	1	4	5
New Mexico GLOBE SRS	3	10	4	2	3
Family Night at the Museum with GLOBE	4	33	3	6	15
Elkhorn Slough Reserve GLOBE SRS	7	21	4	5	3
Greater New Orleans GLOBE Science Symposium	3	27	3	11	8
Project Prairie & GLOBE SRS	2	47	3	15	5
<b>TOTAL</b>	<b>37</b>	<b>212</b>	<b>37</b>	<b>68</b>	<b>50</b>

Table 8. Student event participation by grade band.

Event	Total	K-4	5-8	9-12
GLOBE Alaska SRS	67	23	14	30
St. Peter's Science GLOBE Symposium	7	0	7	0
New Mexico GLOBE SRS	10	0	5	5
Family Night at the Museum with GLOBE	33	0	0	33
Elkhorn Slough Reserve GLOBE SRS	21	0	3	18
Greater New Orleans GLOBE Science Symposium	27	0	8	19
Project Prairie & GLOBE SRS	47	19	28	0
<b>TOTAL</b>	<b>212</b>	<b>42</b>	<b>65</b>	<b>105</b>

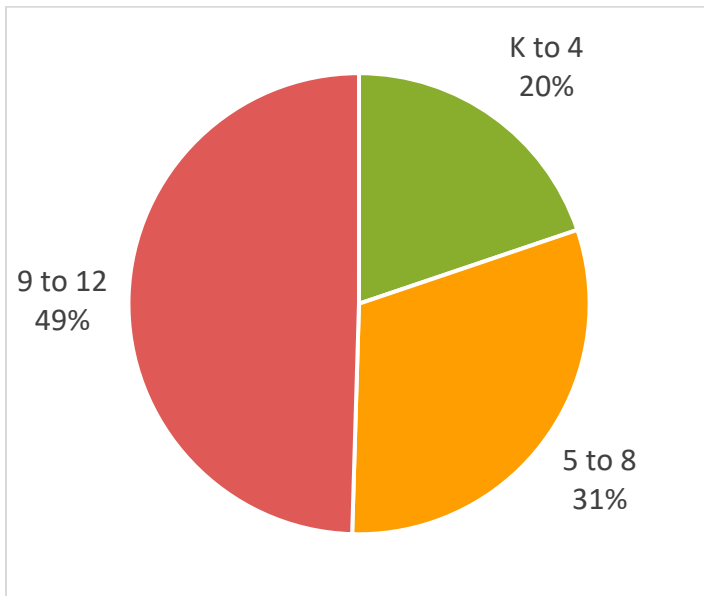


Figure 14. Total student event participation by grade band.

## Appendix E: Test Tables

Table 9. Descriptive statistics of agreement with statements in the measure of student science skills, interest, and self-efficacy on a scale of 1 'strongly disagree' to 6 'strongly agree,' and the summed agreement score of all statements.

<b>Descriptives – Student Pre-Post</b>										
	Pre-test					Post-test				
	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>
I am able to learn new things in science.	160	1	6	5.00	1.229	160	2	6	5.46	.910
I am able to ask good questions to do science research.	160	1	6	4.16	1.378	160	2	6	4.82	1.149
I am able to interpret data in science research.	159	1	6	4.09	1.393	160	1	6	4.75	1.155
I am able to conduct peer review of other students' science research.	160	1	6	4.16	1.537	160	1	6	4.76	1.305
I am good at science.	159	1	6	4.21	1.361	159	1	6	4.80	1.242
I enjoy science.	159	1	6	4.84	1.300	158	1	6	5.20	1.249
I want to have a career in science someday.	158	1	6	3.75	1.669	160	1	6	4.25	1.641
I am proud of my accomplishments in science.	160	1	6	4.60	1.375	158	1	6	5.09	1.207
I am a member of GLOBE.	156	1	6	3.65	2.038	156	1	6	4.78	1.647
<b>SUMMED SCORE</b>	<b>150</b>	<b>11</b>	<b>54</b>	<b>38.45</b>	<b>9.343</b>	<b>153</b>	<b>21</b>	<b>54</b>	<b>43.96</b>	<b>8.054</b>

Table 10. Paired sample *t*-tests of change in agreement from pre-test to post-test on statements in the student retrospective pre-post measure of science skills, interest, and self-efficacy, and the summed agreement score of all statements. There was significant change ( $p < .05$ ) from pre-test to post-test for all statements and the summed score.

<b>Paired Samples t-test</b>							
	<i>n</i>	<i>M</i> (pre)	<i>M</i> (post)	<i>t</i>	<i>df</i>	<i>p</i>	Cohen's <i>d</i>
I am able to learn new things in science.	159	4.99	5.46	-4.786***	158	<.001	.380
I am able to ask good questions to do science research.	159	4.15	4.82	-6.958***	158	<.001	.552
I am able to interpret data in science research.	158	4.08	4.75	-7.458***	157	<.001	.593
I am able to conduct peer review of other students' science research.	160	4.16	4.76	-5.346***	159	<.001	.423
I am good at science.	158	4.20	4.80	-5.998***	157	<.001	.477
I enjoy science.	157	4.83	5.19	-4.895***	156	<.001	.391
I want to have a career in science someday.	158	3.75	4.26	-5.536***	157	<.001	.440
I am proud of my accomplishments in science.	158	4.60	5.09	-5.253***	157	<.001	.418
I am a member of GLOBE.	154	3.65	4.77	-7.637***	153	<.001	.615
SUMMED SCORE	146	38.56	43.72	-7.792***	145	<.001	.645

Table 11. Mixed between-within analysis of variance (ANOVA) of the influence of time (pre-post) and career talks in the event agenda on change in interest in a science career. Time, the career talks, and the interaction of the two all had significant effects.

Mixed Between-Within ANOVA – Career Talks									
	No Career Talk <i>n</i> =67		Career Talk <i>n</i> =91		Test Results				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>df</i>	<i>p</i>	$\eta^2$	<i>power</i>
Pre-test: I want to have a career in science someday.	3.48	1.735	3.96	1.598					
Post-test: I want to have a career in science someday.	3.73	1.763	4.65	1.433					
Time					26.929***	1	<.001	.147	.999
Career Talk					8.158**	1	.005	.050	.667
Time * Career Talk					5.787*	1	.017	.036	.810

Table 12. Mixed between-within analysis of variance (ANOVA) of the influence of time (pre-post) and off campus event site on GLOBE affiliation. Time and off campus event site both had significant effects, but there was no interaction effect detected.

Mixed Between-Within ANOVA – GLOBE Affiliation									
	At School <i>n</i> =30		Off Campus <i>n</i> =124		Test Results				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	<i>df</i>	<i>p</i>	$\eta^2$	<i>power</i>
Pre-test: I am a member of GLOBE.	2.07	1.437	4.03	1.971					
Post-test: I am a member of GLOBE.	3.23	1.813	5.14	1.381					
Time					37.604***	1	<.001	.198	1.000
Off Campus					44.630***	1	<.001	.227	1.000
Time * Off Campus					0.028	1	.868	.000	.053

## GLOBE Local Event Post-Survey

### Info & Cover Sheet

**Event leader:** Please fill out this cover sheet and send it back with your completed student and teacher surveys.

Event leader name:	
Event title:	
Date of event:	
Date surveys completed:	

- If you have more students and/or teachers attending the event than you estimated in your proposal, please print additional copies of the survey for them.
- **Instructions for administration of the student and teacher surveys are on the reverse of this page.** Please read them carefully before your event.
- **If there are any teachers on the event team, do not have them take this teacher survey.** It is only for attending teachers with no other role at the event. All event team members will be emailed an online survey link after the event.
- We have provided you with a postage-paid addressed envelope for returning your completed surveys. If you have lost or misplaced the envelope, please mail the surveys to the address below. The postage fees are a reimbursable event expense.

**Mail cover sheet and completed surveys to:**

Insights Evaluation LLC  
497 Hooksett Road #271  
Manchester, NH 03104  
ATTN: GLOBE Survey Processing

- If you have any **questions**, please contact the U.S. GLOBE office at [usglobeoffice@gmail.com](mailto:usglobeoffice@gmail.com).

**Thank you!**

## Administration of the Student and Teacher Post-Surveys

1. The best time and place to administer the surveys is right after the event at the event site, before students and teachers return home. If absolutely necessary to delay, please administer the surveys as soon as possible after the event.
2. Plan enough time for students to settle down, for students and teachers to complete the surveys, and for you to collect the surveys (~15-20 minutes).
3. Bring a box of pens or pencils for survey participants to use.
4. Provide a quiet space with enough places for all participants to sit down and complete the survey. If possible, space students apart so they can focus on their own surveys.
5. Inform participants that their survey responses are private, and they should NOT write their names on the survey. Let them know that they can skip any questions they do not want to answer or cannot answer, and that they can ask you questions if there's something they do not understand.
6. Make sure each student is completing the survey on their own without input from adults or peers.
7. Do your best to answer questions for participants without leading them toward a particular response.
8. Collect the student and teacher surveys together in a box, folder, or large envelope. For participant privacy, do not look at the survey responses as you collect them. We will report back on the aggregate results.
9. Complete the cover sheet (on the reverse of this page) and return the completed surveys to the indicated address.
10. If you have any questions about the survey or the survey administration, please contact the U.S. GLOBE office at [usglobeoffice@gmail.com](mailto:usglobeoffice@gmail.com).



## Appendix G: Student Survey Supporting Literature

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