Returning to the GLOBE Regional Student Symposia after a 4-Year Pandemic Pause: Evaluation of the 2023 GLOBE SRS

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Executive Summary

Introduction

The 2023 U.S. Regional Global Learning and Observations to Benefit the Environment (GLOBE) Student Research Symposia (SRS) were supported by the National Aeronautics and Space Administration (NASA, Grant No. 80NSSC18K0135) and Youth Learning as Citizen Environmental Scientists (YLACES). The GLOBE Program offers an array of resources to support youth engagement in environmental science such as learning activities, research protocols, data sharing, mentorship, educator professional development, and expert consultation. The annual multi-day SRS allow students and educators to share the results of their GLOBE research projects in an immersive science learning environment, get feedback from knowledgeable reviewers and peers, and participate in experiential learning activities.

Spring 2023 marked a return to the Regional SRS after a four-year pause following the 2019 events due to the COVID-19 pandemic. The six GLOBE U.S. Regions were consolidated into four events due to lower registration than before the pandemic: Midwest, Northwest, Pacific, and the Northeast & Mid-Atlantic and Southeast regions merged with the Southwest. Funding for travel, meals, and lodging supported SRS attendance for nearly all participants, expanding access to those for whom it would have otherwise been out of reach based on need or geography and those new to the GLOBE community.

Participation in the 2023 Regional SRS

In total across the four regional symposia, 201 students and 52 educators from 51 schools and organizations, 18 GLOBE Partners from 10 GLOBE Partnerships, 44 STEM Professional reviewers, and 62 others attended, and 80 GLOBE research projects were presented. Although registration was lower in 2023 than in 2019, it recovered to pre-pandemic levels for the 2024 Regional SRS.

201 Students

52 Educators

80 Projects

44 Reviewers

59% of students were from schools where the majority are identified as **economically disadvantaged.**

50% of students were from schools where the majority 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.

According to educators, the schools participating in the GLOBE 2023 Regional SRS include representation of rural (44%) and urban (31%) communities. School enrollment data show at least half of participating students represented schools where the majority of students are economically disadvantaged, and where the majority of students identify as a race or ethnicity that is an underrepresented minority in STEM (URM students; specifically, Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native). Data from parent/guardian completed student registrations show that at least 31% of participating students were from households with annual incomes under $50,000—among them at least 15% from households with annual incomes below the federal poverty line—and 35% identified as a race or ethnicity underrepresented in STEM; 60% identified their gender as female.

Student Outcomes of the GLOBE SRS

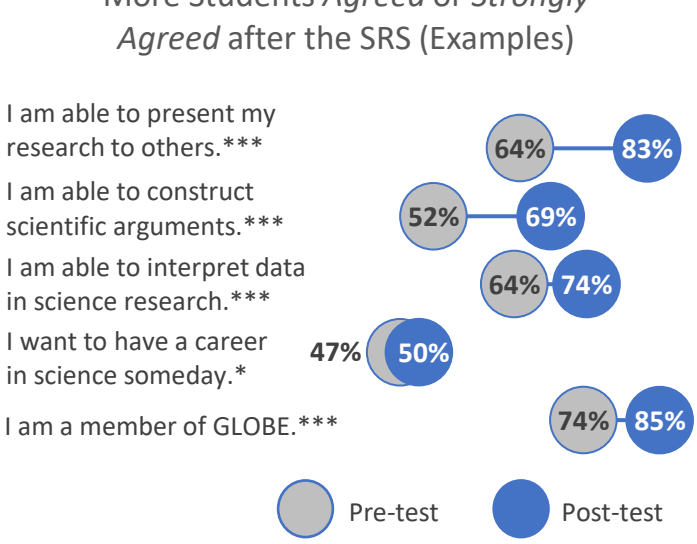
- **Students learned about science practices and 21st century skills through working on their GLOBE projects.** For every skill listed in our student survey, 75% or more students reported learning at least *some* about them by working on their GLOBE projects. 'Work together as a group' had the highest average rating, with 66% of students reporting they learned *a lot* about this.

- **Most students (over 80%) reported that participating in the SRS impacted their understanding of the scientific process and what it's like to do science research.** Some also experienced a broader change in their worldview and benefited from exposure to different perspectives and ways of doing science through their interactions with scientists and other students at the SRS. Many students came into the SRS thinking they would be "scary," "boring," "serious," "tense," or "intimidating," but left describing them as "fun," "interesting," "cool," "welcoming," and a "good experience."

> **"I enjoyed seeing other research presentations like mine and hearing their experience because I am not alone in thinking 'I am still learning.'" —Student, Pacific SRS**

> **"I got to learn how different scientists get to do their jobs, and how it impacts the environment." —Student, Midwest SRS**

- **Student survey results show significant positive change from pre-test to post-test for all science self-efficacy items, and for most items about value of science and belonging in science**. Students rated their agreement with statements regarding their ability to do science (science self-efficacy), how important they find science (value of science), and sense of belonging, representation, and affiliation in the scientific community at pre-test and post-test so we could measure change from before to after the SRS. The results overall show positive change.

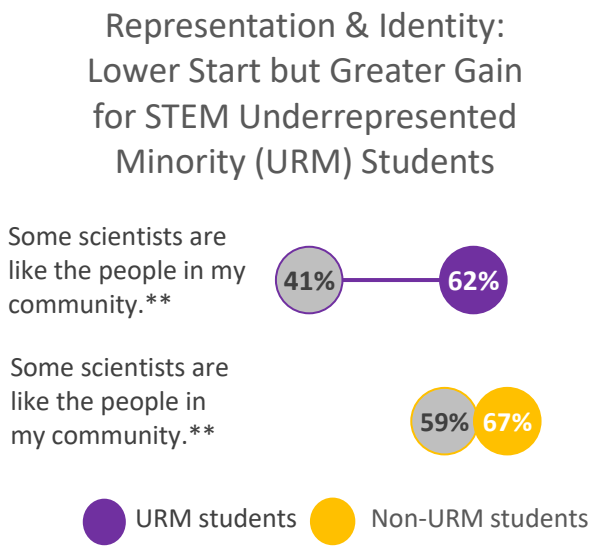


- **Comparisons of 2023 and 2019 data suggest that the SRS experience can help mitigate pandemic science learning loss.** Pandemic-related school disruptions resulted in documented STEM learning loss for K-12 students, disproportionately so for students from low-income households and Black students (Rotermund & Freyman, 2023). Comparison of evaluation data from the 2019 and 2023 GLOBE SRS align with these findings, showing that students' average pre-test ratings on our measures of science self-efficacy and value of science were lower in 2023 than in 2019. However, the average ratings also *increased more* from before to after the SRS in 2023 than in 2019, suggesting that the SRS experience narrowed the pandemic gap.

> **I was nervous because I haven't done this in 4 years ... [but now I know] I'm confident." —Student, Northwest SRS**

- **Students identified as underrepresented minorities in STEM based on race or ethnicity (URM students) had significantly lower average agreement with multiple science self-efficacy statements at both pre-test and post-test than non-URM students but experienced a similar increase from before to after the SRS.** There was no significant difference in how much things changed between the pre-test and post-test between URM and non-URM students—for both groups they increased roughly in parallel. However, URM students did not show the same increase in their sense of belonging at the SRS as their non-URM counterparts from pre-test to post-test.

- **The sense of science representation and identity among URM students started lower but increased more from before to after the SRS.** URM students started with significantly lower average agreement than non-URM students on the statement 'some scientists are like the people in my community,' but the average agreement *increased more* for URM students than non-URM students from before to after the SRS, narrowing the gap to non-significance by post-test. Research shows that students' engagement with STEM benefits from seeing scientists who look like them and the people in their communities (e.g. Barakat, 2022; Martin & Fisher-Ari, 2021).



"I liked how non-stressful and inclusive it was." —Student, Northwest SRS

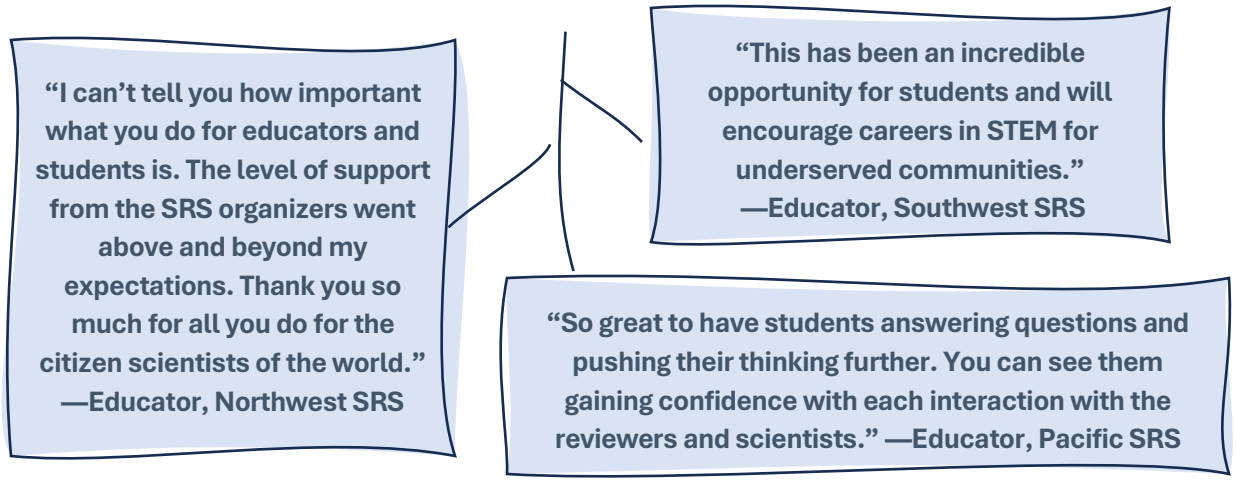
"I enjoyed doing the hands-on activities because I felt like a scientist out there and I enjoyed talking to professionals who work in the area I want to work in." —Student, Pacific SRS

Educator Feedback

- **In our educator post-survey, all responding educators reported that participating in the SRS improved their ability to integrate science research into their classroom or program.** Overall, educators *agreed* that GLOBE projects helped learners build 21st century and science practice skills, especially making observations and recording data, collaborating on a group project, and communicating the outcomes of their research investigations.

- **Educators were overwhelmingly satisfied with the SRS events.** Ninety-eight percent of educators were *very satisfied* or *satisfied* with the SRS overall for themselves, and 97% were *very satisfied or satisfied* for their learners. Educators were also highly satisfied with the SRS locations (100%), venues (98%), and schedules (98%). Other aspects of the SRS that received high satisfaction ratings from educators include student research presentations to reviewers (93%), student research presentations to other students (93%), and hands-on science activities (93%).

- **About half of the educators (49%) reported that 2023 was their first GLOBE SRS.** A third (33%) had participated in one Regional or Local SRS before, and the rest (16%) had participated in two or more.



- **Of the available GLOBE resources, educators most frequently used consultation and support from their local GLOBE Partnership (81%), emails from the U.S. GLOBE office (57%), and the science practices resources pages on the internal GLOBE SRS webpages (45%).** While the GLOBE Watercoolers (informal virtual discussions), educator blog posts, and mentorship with a STEM Professional from the GLOBE International STEM Network were not as widely used by either educators or learners, there is interest in utilizing those resources in the future. Additionally, 25 of the 42 educators (59%) reported participating in a professional development activity at the SRS and they generally rated their professional development experience very highly.

Reviewer Feedback

Our reviewer survey response rate was fairly low, but all respondents were either *very satisfied* (69%) or *satisfied* (31%) with the GLOBE SRS event as a science learning experience for students. They cited unique aspects of the SRS compared with traditional student science fairs. Some wanted more training for reviewers, especially on the review criteria and providing student feedback.

Key Findings & Recommendations

Overall, the evaluation results provide ample evidence that the GLOBE U.S. 2023 Regional SRS were successful in achieving their objectives of increasing students' interest and engagement in science, broadening participation in science learning activities, and building a supportive scientific community of students, educators, and STEM Professionals. Although attendance returned to pre-pandemic levels in 2024, continued efforts to reduce barriers to participation will allow more students and educators to access the demonstrated benefits of the SRS.

Key finding: Working on GLOBE research projects for the SRS helped students learn science practices and 21st century skills, and participation in the SRS itself had a positive influence on students' science self-efficacy and value of science. The SRS offered students a unique opportunity to practice their science skills and to see how others are applying them in different ways, broadening their perspective on science and the world around them.
Recommendation: Since it began in 2016 the GLOBE SRS model continues to show evidence of positive outcomes for students' science self-efficacy and value of science. These findings warrant continued support for the Regional SRS and continued efforts to expand access so that more students may benefit from working on GLOBE research projects and presenting their research at the SRS.

Key finding: Evaluation results suggest that the return of immersive science activities like the GLOBE SRS may mitigate some of the damage the pandemic had on student engagement in STEM.
Recommendation: Promote participation in the SRS to schools and programs as a way to help with STEM learning recovery, citing these positive outcomes. Support GLOBE Partnerships to help them share this message with their regional school districts and programs and help them steer educators to the appropriate GLOBE resources for their learners if needed.

Key finding: Participation in the SRS helped students who identify as a race or ethnicity underrepresented in STEM to see that scientists can be like the people in their own communities, suggesting that GLOBE's efforts toward representation at the SRS is yielding benefits for students.
Recommendation: Intentionally fostering the sense of belonging and inclusion among students underrepresented in STEM at the GLOBE SRS is an area for improvement to build on successes in reducing barriers, expanding access, and broadening participation. This includes continuing efforts to recruit and retain a diverse pool of STEM Professional reviewers.

Key finding: The 2023 Regional SRS marked a return to the annual events after a four-year pause. Registration was lower than prior to the pandemic in 2019. Yet nearly half of the participating educators were new to the SRS, suggesting that educators are continuing to join the GLOBE community.
Recommendation: Explore how barriers to participation have changed since the pandemic and new ways to address them to improve educator retention. At the same time, continue recruitment of new educators into the GLOBE community and track participation to follow trends over time.

Key finding: NASA and YLACES sponsorship has supported not only the SRS events themselves but also investments in GLOBE U.S. Partner outreach to schools in minoritized communities and funding to cover SRS travel expenses. The results of these investments were evident in the participation of students from low-income communities and households, and the participation of students identifying as a race or ethnicity underrepresented in STEM.
Recommendation: NASA and YLACES support remains critical to the objectives of reducing barriers, expanding access, and broadening participation in the GLOBE SRS and in STEM.

About the 2023 GLOBE Regional SRS

The 2023 U.S. Global Learning and Observations to Benefit the Environment (GLOBE) Student Research Symposia (SRS) were supported by the National Aeronautics and Space Administration (NASA, Grant No. 80NSSC18K0135) and Youth Learning as Citizen Environmental Scientists (YLACES). The GLOBE Program offers an array of resources to support youth engagement in environmental science research in the U.S. and worldwide, including learning activities, research protocols, data sharing, mentorship, educator professional development, and expert consultation. The annual multi-day symposia give students and educators an opportunity to share the results of their GLOBE research projects in an immersive science learning environment, get feedback from knowledgeable reviewers and peers, and participate in experiential learning activities.

The 2023 SRS marked a return to the Regional SRS after a four-year pause following the 2019 events due to the COVID-19 pandemic. In total, 201 students and 52 educators from 51 schools and organizations, 18 GLOBE Partners from 10 GLOBE Partnerships, 44 STEM Professional reviewers, and 62 others attended, and 80 GLOBE research projects were presented (Tables 1, 2). The six GLOBE U.S. Regions were consolidated into four events due to lower registration than prior to the pandemic; the Northeast & Mid-Atlantic and Southeast regions merged in with the Southwest. However, registration recovered to pre-pandemic levels in 2024. (Figure 1.) Approximately $83,000 in GLOBE travel, meals, and lodging funds supported SRS attendance, expanding access to those from schools for whom it would have otherwise been out of reach based on need or geography, and those new to the GLOBE community.

Table 1. Students, educators, STEM Professional reviewers, and projects at the 2023 Regional GLOBE SRS.

Region	Location	Students	Educators	Reviewers	Projects
Midwest April 21-23	University of Wisconsin – Madison WI Nelson Inst. for Environmental Studies	46	11	10	27
Northwest April 24-25	University of Alaska – Fairbanks AK Troth Yeddha' Campus	65	21	17	26
Pacific May 12-13	Elkhorn Slough National Estuarine Research Reserve – Watsonville CA	37	11	9	12
Southwest May 19-20	University of Texas – Tyler TX	53	9	8	15
	TOTAL	**201**	**52**	**44**	**80**

Table 2. GLOBE U.S. Partnerships involved in the 2023 Regional GLOBE SRS.

MIDWEST	NORTHWEST
University of Wisconsin-Madison University of Toledo Wayne RESA	University of Alaska Fairbanks
PACIFIC	**SOUTHWEST**
Elkhorn Slough National Estuarine Research Reserve WestEd/UC Berkley NASA Jet Propulsion Laboratory	Texas STEM Coalition Berks Nature NASA Stennis Space Center University of Texas - Tyler

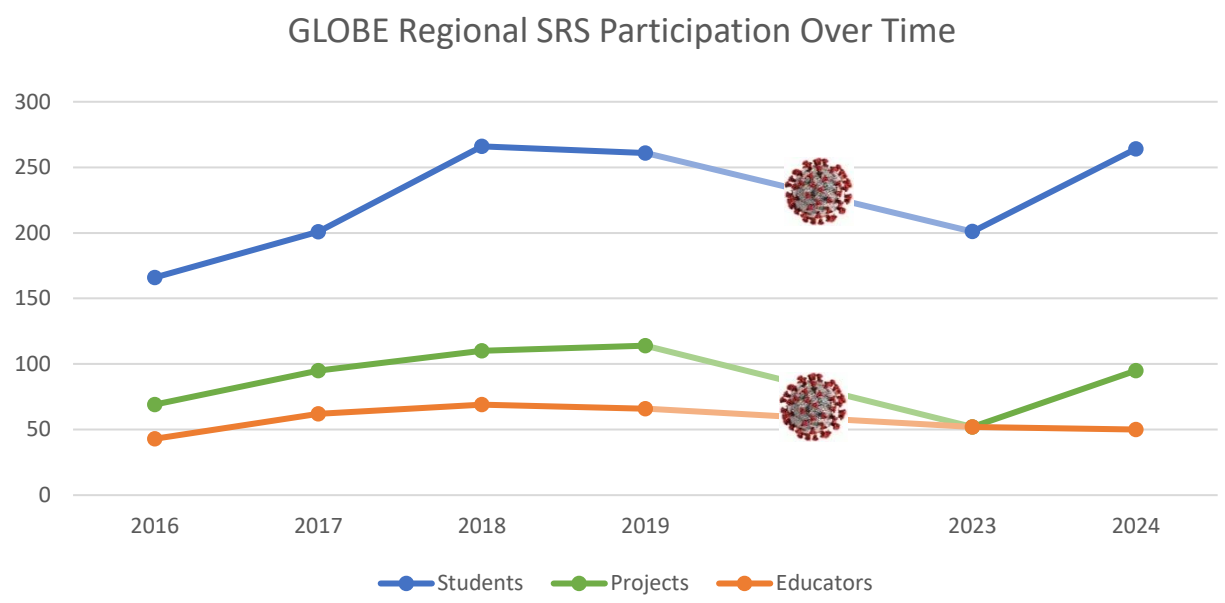


Figure 1. GLOBE Regional SRS participation from 2016 to 2024, displaying the COVID-19 pandemic attendance gap and recovery.

The agenda for each 2023 regional symposium varied somewhat, taking advantage of host city attractions and local expertise. All four symposia included opening remarks, student poster presentations with peer and STEM Professional reviews (required components), opportunities to meet STEM Professionals and other students, hands-on science activities, and closing ceremonies. Three symposia also featured keynote speakers and tours or field trips. One hosted a STEM career talk, another provided family activities, and a third offered an opening blessing and land acknowledgement by an Indigenous Elder and centering singing and drumming.

Photo: 2023 Northwest Regional SRS, University of Alaska, Fairbanks AK
Photo credit: C. Buffington

About This Report

The focus of this report is evaluation findings from the 2023 SRS. These findings are intended to help GLOBE program leaders and funders better understand who participates in the SRS and the impact of the SRS on participating students and educators, and to share participant feedback. We also draw some comparisons with the 2019 SRS to investigate how things may have changed during the pandemic. Data sources were student and educator registration data including demographic information,[1] student survey data collected at the beginning (pre-test) and end (post-test) of each SRS, educator survey data collected at the end (post-only) of each SRS, reviewer survey data collected after the SRS, and event reports completed by the GLOBE Partner SRS leads in each region after the SRS. Additionally, we gathered publicly available school enrollment data to provide information about the communities served by the SRS. Please see Appendix A for more information about survey instruments and samples.

Who Participated in 2023 GLOBE Regional SRS?

This section describes the school context and demographics of students and educators participating in the SRS. In addition to serving a descriptive purpose, the results will help program leaders to assess the effectiveness of efforts to make the SRS accessible for students from underrepresented groups and communities who may not typically have access to STEM experiential learning opportunities.

Participating Schools

A total of 201 students and 52 educators participated in the Regional SRS. Of the students and educators from schools with publicly available enrollment data,[2] 59% students and 61% of educators were from schools where a majority of students are identified as economically disadvantaged.[3] Fifty percent of students and 56% of educators were from schools where a majority of students are identified as a race/ethnicity underrepresented in STEM, specifically Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native.[4] Educators described the location of their school or program as rural (44%) urban (31%), and suburban (21%).

59% of students were from schools with the majority identified as **economically disadvantaged.**

50% 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.**

[1] Student registrations are completed by a parent or guardian.
[2] School enrollment data were publicly available for 95% of students and 88% of educators. See Appendix A.
[3] "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).
[4] 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 Demographics

Student demographics are drawn from the SRS registration survey filled out by their parents or guardians. The registration survey was completed for 98% of the 201 participating students.

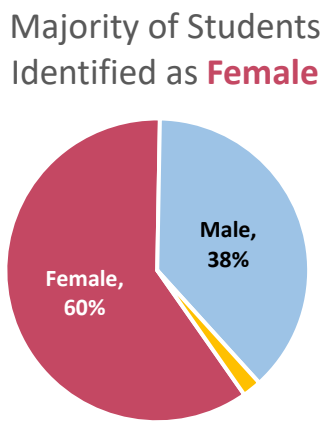


Figure 2. SRS student participant gender identities as reported by parents/guardians.

Grade

The registration data show that most students at the 2023 SRS were at the high school level. Sixty-two percent were in grades 9 to 12, 28% in grades 6 to 8, and 10% in grades 4 to 5. This is a slight shift from younger to older students since the 2019 SRS, when 18% were in grades 4 to 5.

Gender

Parents were asked which response option(s) best described their child's gender, selecting all that apply. More students at the 2023 SRS were identified by their parents or guardians as female (60%) than male (38%) or non-binary or other preferred description (2%). (Figure 2.)

Race & Ethnicity

Parents and guardians were asked which response option(s) best described their child's race or ethnicity, selecting all that apply. Most (86%) selected only one race or ethnicity, 13% selected two, and 1% selected three, for a total of 227 selections for the 197 registered students. The most frequently selected response was White (45%), followed by Hispanic, Latino/a/x, or Spanish origin (19%), Native American or Alaskan Native (11%), Asian (8%) and Middle Easter or North African (8%), and Black or African American (5%). Three percent preferred not to answer and 1% selected 'other.' (Figure 3.)

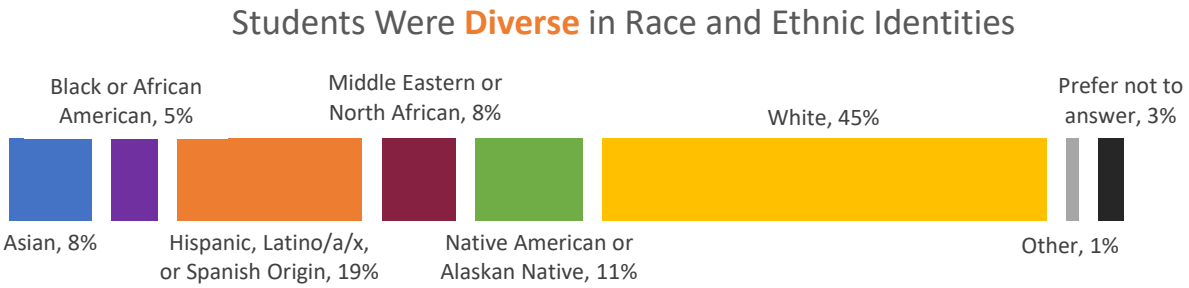


Figure 3. SRS student participant race and ethnic identities as reported by parents/guardians.

Parents and guardians reported the languages they speak with their children other than English most frequently as Spanish (12), Arabic (6), and multiple Indo-Aryan languages (7) including Sinhala, Bangla, Hindi, Malayalam, Marathi, and Gujrati. Other languages included Albanian, Greek, Mam (Mayan), Mandarin (Chinese), and Yup'ik (Alaskan Native).

Household Demographics

Parents and guardians were asked to report their approximate annual household income. More than a quarter (27%) preferred not to answer. The remainder were broadly distributed across household income levels, including 15% below the 2023 federal poverty level (FPL).[5] (Figure 4.)

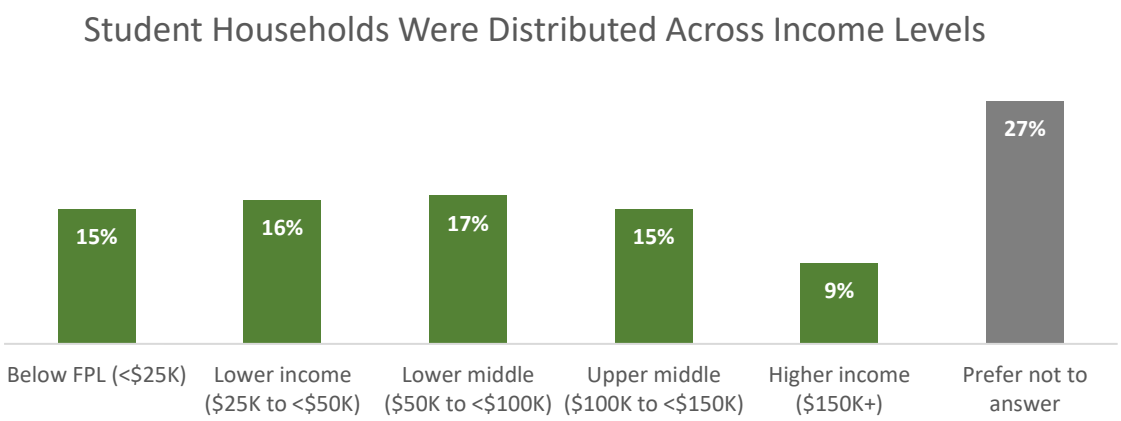


Figure 4. Parents/guardians reported their annual household income (n=197).

Parents and guardians were asked to report the highest level of education completed by any adult member of their household. Just under half (49%) reported an associate degree or higher with most reporting a master's (20%) or bachelor's (18%) degree; 39% reported no college degree, and 12% preferred not to answer. (Figure 5.)

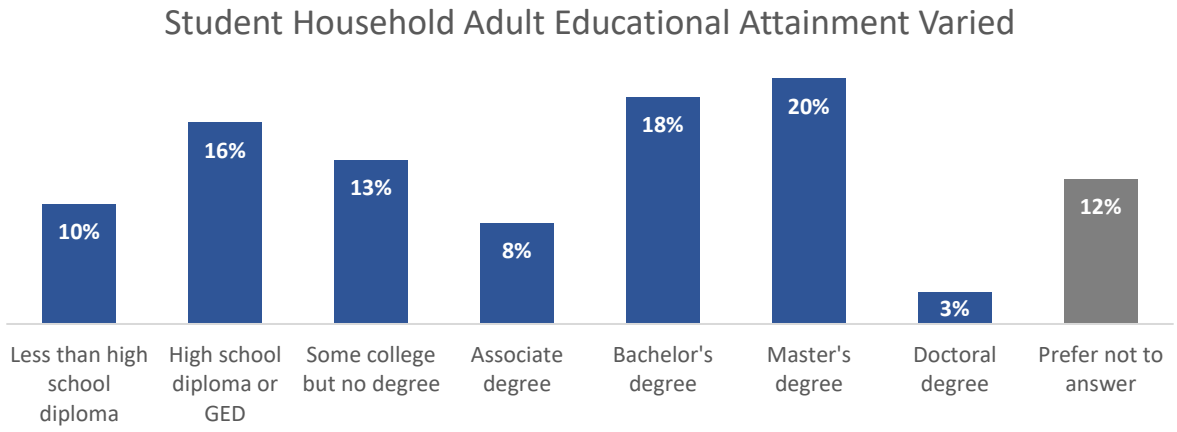


Figure 5. Parents/guardians reported the highest level of education completed by any adult member of their household (n=196).

Defining "Underrepresented Minority (URM) Students"

Sometimes in reporting on how students' demographic characteristics relate to SRS outcomes, we use the term 'underrepresented minority students' or 'URM students' in comparison to 'non-URM students.' URM students refers here to students whose parents/guardians identified their race or ethnicity as Black or African American; Hispanic, Latino/a/x, or Spanish origin; or Native American or Alaskan Native in

[5] The 2023 poverty level for a family of three is $24,860 and for a family of four $30,000. Source: https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines.

their SRS registration survey, whether or not an exclusive selection. According to a recent National Science Foundation report, Black, Hispanic, and American Indian or Alaskan Native persons are underrepresented in STEM education from the bachelor's degree level and above relative to their representation in the U.S. population (National Center for Science and Engineering Statistics, 2023). Furthermore, a higher percentage of Black, Hispanic, and American Indian or Alaska Native students in the U.S. attend high-poverty schools (Irwin et al., 2023), which may limit their access to high quality STEM learning facilities, resources, and activities. Consistent with these national circumstances, in our sample of 2023 SRS participants, a higher percentage of URM students (45%) than non-URM students (12%) attend schools where more than three-quarters of the students are economically disadvantaged.[6] It is therefore critical that we explore group differences in SRS experiences and outcomes, examine disparities, consider their causes, and actively partner with GLOBE communities to offer an inclusive event that mitigates rather than perpetuates the educational injustices URM students may encounter.

Yet we recognize the limitations of racial and ethnic categories to represent the range of cultural identities comprising them, which may also differ in their representation in STEM (Bhatti, 2021). The term 'underrepresented' itself has been the subject of scrutiny for its connotation of responsibility for the underrepresentation being assigned to minoritized people, rather than to systemic racism, structural inequalities, marginalization, and oppression; alternative terms such as 'underrecognized' (Nwangwu, 2023) and 'excluded identities' (Walden et al., 2018) have been proposed. We use the term URM here nevertheless to align with the language commonly used in reporting on STEM representation at this time to avoid confusion but commit to continue listening and learning going forward.

[6] $X^2(3)=28.231$, $p<.001$, $n=176$.

Student SRS Outcomes

In this section, we report on results of the student pre-test (at the beginning of the SRS) and post-test (at the end of the SRS) surveys. Some of the 201 students attending the events did not complete one or both surveys or respond to every item in the surveys, so the number of responses varies in the pre-test, post-test, and matched pre-post results. Please see Appendix A for more information on survey samples.

Science Practices & 21st Century Skills

For the first time this year, we asked students how much they learned about different science practices and 21st century skills by working on their GLOBE projects leading up to the event. They rated each on a 4-point scale of *none* to *a lot*. 'Work together as a group' had the highest average rating with 66% of students reporting they learned *a lot* about this.[7] For every skill or practice listed, 75% or more of the students reported learning at least *some* about them by working on their GLOBE projects. (Figure 6.)

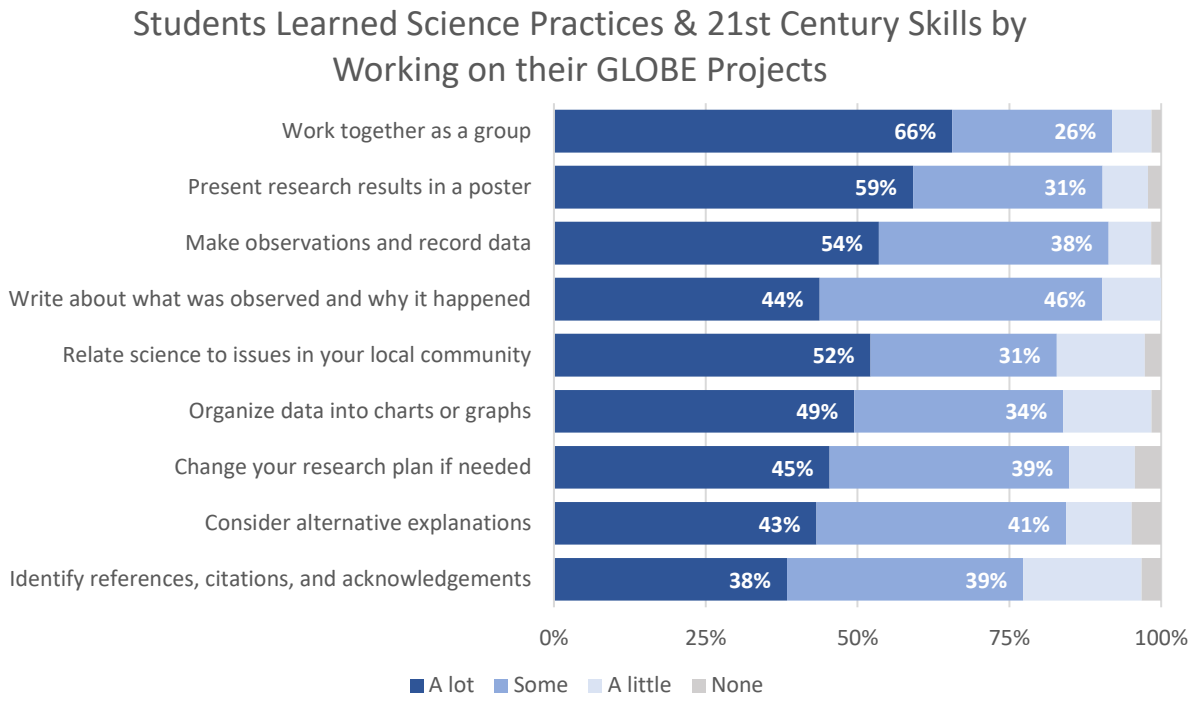


Figure 6. Student ratings of how much they learned about science practices and 21st century skills by working on their GLOBE research projects on a 4-point scale of none *to* a lot, *in descending order of average rating (n=186).*

Science Self-Efficacy and Value of Science

As in previous years, students rated their agreement with a series of statements about their ability to do science (science self-efficacy) and how important they find science (value of science) before and after the SRS on a 6-point scale of 1 *strongly disagree* to 6 *strongly agree*. There was significant positive change from pre-test to post-test for all science self-efficacy items as well as most items for the value of science. The only exception was 'I am proud of my accomplishments in science,' which still had average ratings above *agree* (5.0) at both pre-test and post-test. (Tables 3 and 4, p. 17; Figure 8, p. 18.)

[7] Throughout this report, single quotation marks indicate a 'survey item,' italics indicate a *survey response option*, and double quotation marks indicate a "participant quotation."

Table 3. Average student agreement on science self-efficacy statements before (pre-test) and after (post-test) the SRS (n=165).

Student Pre-Post Survey Items: Science Self-Efficacy (all students)	**Average Agreement**	
Rating scale of 1 *strongly disagree* to 6 *strongly agree*	**Pre-test**	**Post-test**
I am able to learn new things in science.*	5.36	5.47
I am able to ask good questions to do science research.***	4.62	4.93
I am able to analyze data to do science research.**	4.83	5.01
I am able to interpret data in science research.***	4.75	5.02
I am able to construct scientific arguments.***	4.55	4.87
I am able to present my research to others.***	4.85	5.28
I am able to conduct peer review of other students' science research.***	4.60	5.00
I am good at science.*	4.82	4.95

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 4. Average student agreement on value of science statements before (pre-test) and after (post-test) the SRS (n=165).

Student Pre-Post Survey Items: Value of Science (all students)	**Average Agreement**	
Rating scale of 1 *strongly disagree* to 6 *strongly agree*	**Pre-test**	**Post-test**
Being good at science is important.*	5.24	5.33
I want to have a career in science someday.*	4.25	4.40
I am proud of my accomplishments in science.	5.16	5.14

*** $p < .001$, ** $p < .01$, * $p < .05$

Comparing 2019 and 2023

Some of the science self-efficacy and value statements were included in both the 2019 and 2023 SRS student surveys. Comparing across years, students' average ratings of their science self-efficacy and value of science were lower in 2023 than before the pandemic in 2019 but increased more from pre-test to post-test, narrowing a gap. (See examples in Figure 7.) The pre-test difference may reflect limited out-of-school science opportunities for students during the pandemic, including the cancelation of the SRS.

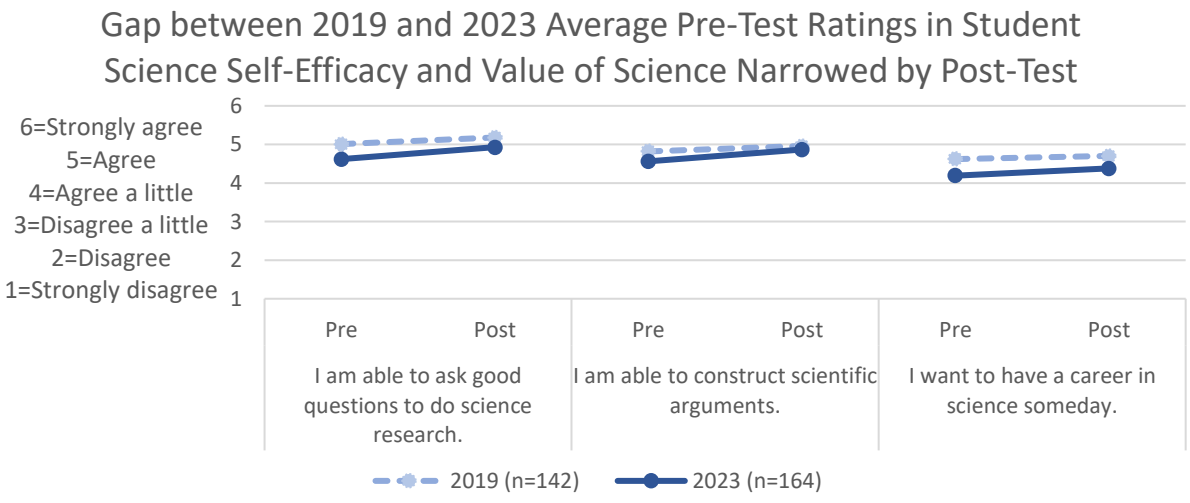


Figure 7. Difference between 2019 and 2023 average student ratings of science self-efficacy and value of science before (pre-test) and after (post-test) the SRS; in 2023 pre-test averages were lower but the gap narrowed by post-test.

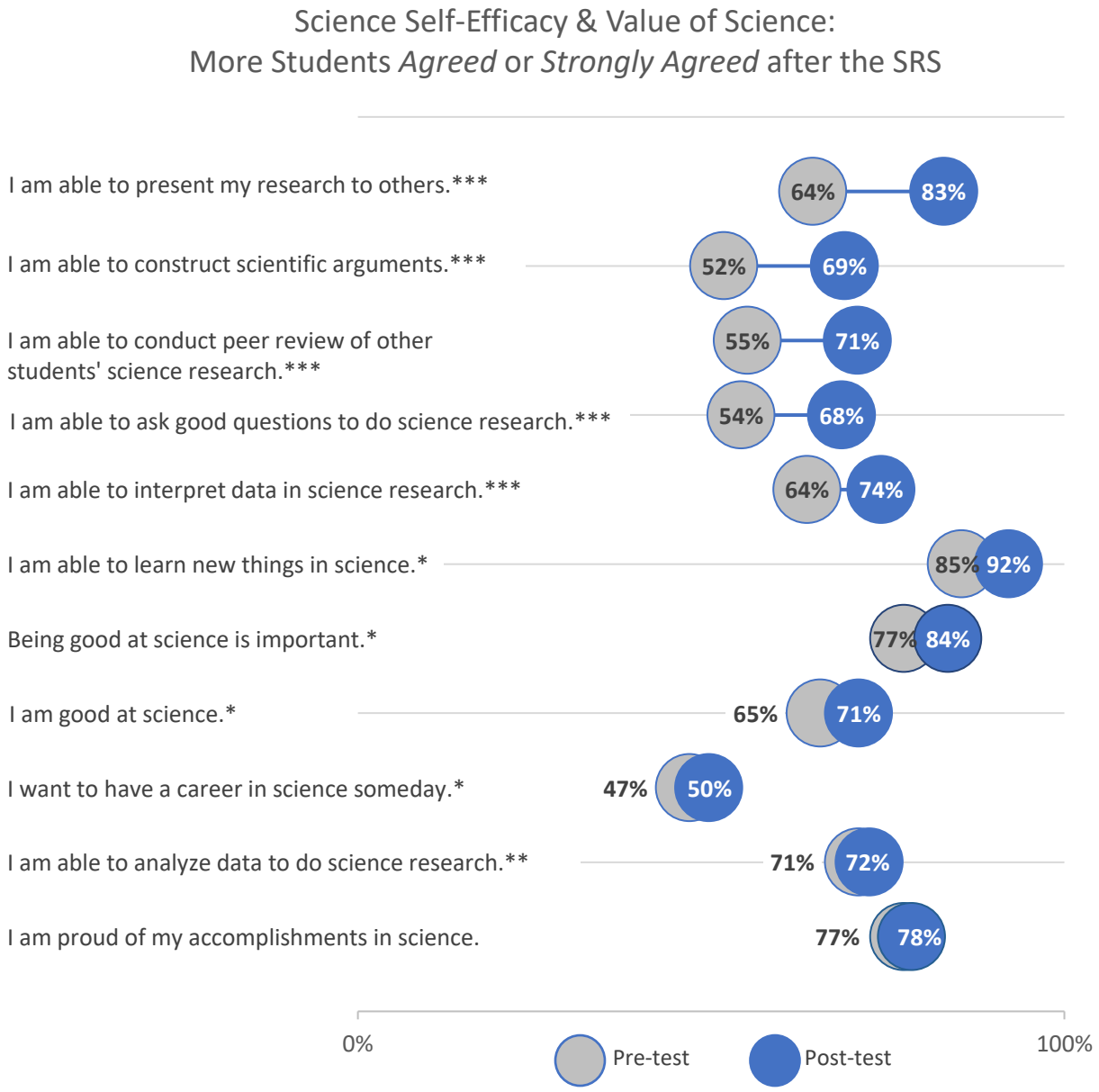


Figure 8. Percentage of students agreeing *or* strongly agreeing *with science self-efficacy and value of science statements before (pre-test) and after (post-test) the SRS, in descending order of difference in average agreement from pre- to post-test (n=165).*

Understanding the Scientific Process

In the post-test survey, students were asked if participating in the SRS impacted their 'understanding of the scientific process and what it's like to do science research,' and 83% responded *yes*; 14% responded *don't know/not sure*, 2% responded *no*, and 1% did not respond. (Figure 9.) All of the students responding *no* (3) explained in open-ended comments that they already knew a lot about the scientific process and science research, claiming "most of the stuff I did with GLOBE, I already knew how to do," "I already knew almost everything they showed us," and "I had a really strong understanding of the scientific process and what it's like to do scientific research before participating in the SRS."

Of 25 students responding *don't know/not sure*, several similarly described already being familiar with the scientific process (4), some explained that they just did not know (4) or did not understand the question (2), and some did not provide an explanation (5). One (1) reported "not really," and a few (3) expressed personal challenges, for example, "science is not my best subject, it's rather confusing for me. Also, I'm shy," "I did not want to talk to anyone," and "it is really hard until you find where you belong." Otherwise, most (6) had a positive experience even if they did not specify their learning or interest as related to the scientific process. They explained, for example, "so, I haven't really noticed. But I did like coming," "I am not sure if it helped me better understand the scientific process, but I thought that I learned a lot about a lot of different things," and "it was nice, I liked it, but I don't think this is for me."

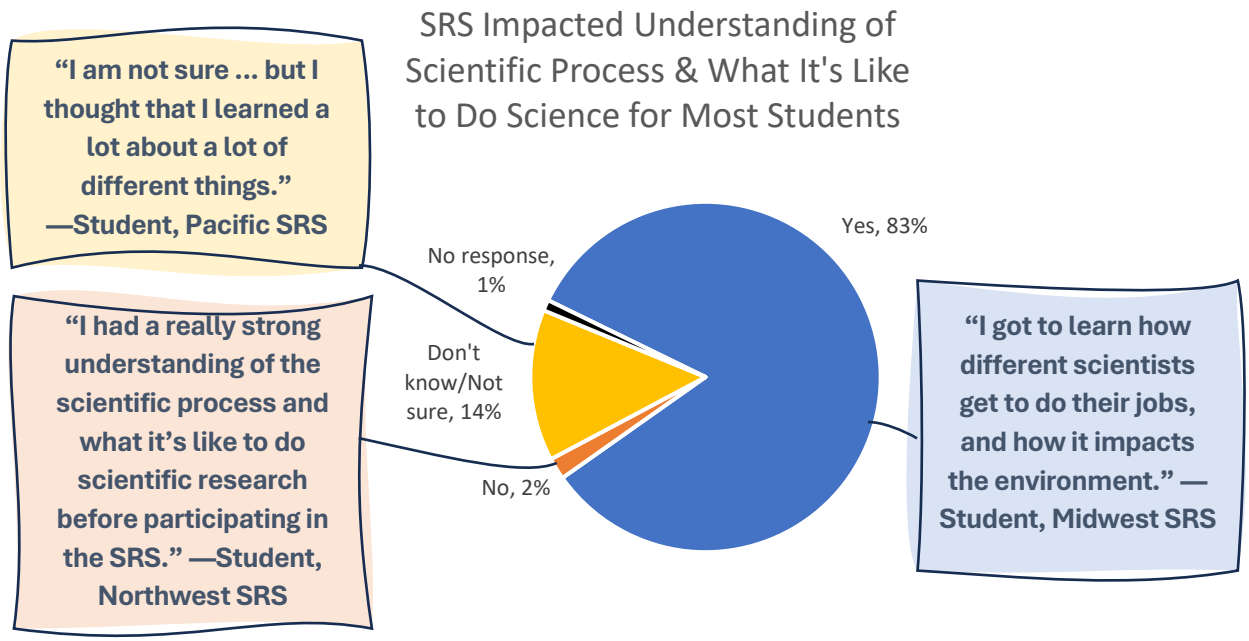


Figure 9. Student responses to the question, 'Did participating in the SRS impact your understanding of the scientific process and what it's like to do science research?' (n=178).

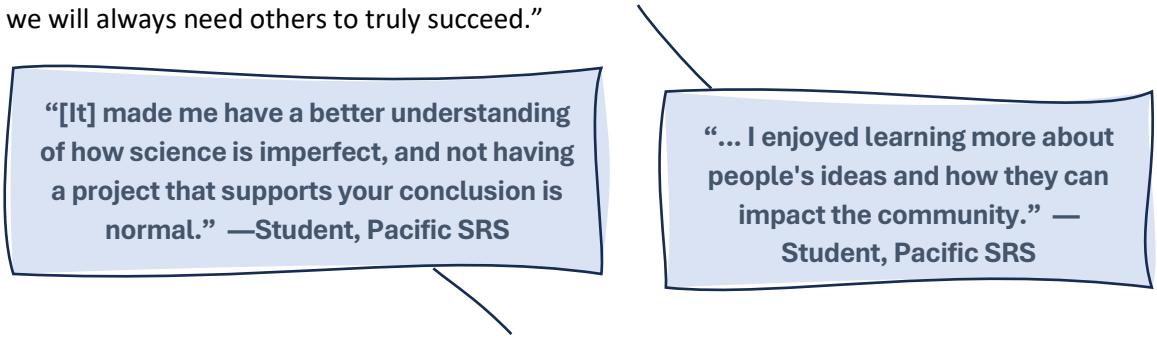
One hundred forty-eight students responded that *yes*, the SRS did impact their understanding of the scientific process and what it is like to do science research, and 140 of these provided explanations for their affirmative response. Many referenced a **general increase of their understanding (45),** [8] for example, "I feel like I really understand more about science," and "I feel like it expanded my knowledge and understanding of what goes into scientific research and helped me understand different ways of doing it." The explanations frequently referenced **gaining more specific knowledge or skills (32)** too, such as "I learned more about presenting and analyzing data and conducting research," "being able to construct and interpret an experiment," "learned more about meteorology," and "I knew this before, but I found that places, time, number of sites visited, and number of trials taken play a part."

Some described a **broader change in outlook (16),** explaining "the SRS impacted my understanding of the scientific process in a positive way, it allowed me to be more reflective and mindful of the things around me," "participating in the SRS helped me to gain a broader understanding of how the scientific

[8] Some explanations referenced more than one theme; theming of explanations is not mutually exclusive.

principle is applied in the real world," and "participating helped open my mind to what I could improve on, and what other people are doing. I learned citizen science and the importance of it." A couple of others (2) also referenced new recognition of the value of GLOBE citizen scientists: "It showed me how people are a major source of research for NASA," and "was able to see the influence of a large database on cultivating new scientific discovery." Other themes to emerge include the following.

- **Exposure to different perspectives and ways of doing science (18).** Examples: "The keynote speaker presentation and peer review really helped me to understand how different people apply the scientific method to different situations," "I got to learn new things from other people and their projects. It gave me new ideas for how to do things in a different way," "I had never been to a scientific research symposium, but I enjoyed learning more about people's ideas and how they can impact the community," and "science is not, nor ever should be done in a vacuum. After meeting other students, I realized science encompasses many more perspectives, and that we will always need others to truly succeed."



- **Learning about the realities of applied science (12).** Examples: "Participating in [the] GLOBE SRS really helped my understanding of what is necessary in order to actually conduct an experiment. I now recognize the necessary steps needed," "I feel like I have a stronger understanding of what it's like to be in the field and why research is important," "[it] made me have a better understanding of how science is imperfect, and not having a project that supports your conclusion is normal," and "it allowed me to realize that scientific process isn't perfect and that it's scrappy and gruesome but the end product is worth it."

- **Interacting with real scientists (6).** Examples: "I was able to see how scientists actually do science," "I feel like after having the opportunity to listen to GLOBE and NASA members, I definitely learned more about the process of scientific research," "I got to learn how different scientist get to do their jobs, and how it impacts the environment, and "it's not just sitting in labs and running around with a microscope. All different types of people can be scientists."

- **Increased interest in science (6).** Examples: "It made me so much more interested in learning about science," "I learned many things and details about science research that I did not know of, it's made science seem much more interesting to me," and "by being hands-on and being able to choose what project makes science more fun and intrigued my interest in learning new things. Not being forced to study something that I don't have an interest in is helpful!"

Outcomes by Demographics

- Students identified as underrepresented minorities in STEM based on race or ethnicity (URM students) had *significantly lower* average agreement with multiple science self-efficacy statements at both pre-test and post-test than non-URM students. (Table 5.) However, there was no significant difference in how much things changed between pre-test and post-test between URM and non-URM students—for both groups they increased roughly in parallel.

Table 5. Significant differences in average agreement on science self-efficacy statements between URM students (n=67) and non-URM students (n=96) at pre-test and post-test.

Student Pre-Post Survey Items: Differences in Science Self-Efficacy		**Average Agreement**	
Rating scale of 1 *strongly disagree* to 6 *strongly agree*	**Time**	**URM**	**Non-URM**
I am able to learn new things in science.	Pre-test**	5.21	5.48
	Post-test**	5.30	5.59
I am able to ask good questions to do science research.	Pre-test***	4.30	4.86
	Post-test**	4.57	5.16
I am able to analyze data to do science research.	Pre-test***	4.52	5.06
	Post-test***	4.75	5.20
I am able to interpret data in science research.	Pre-test***	4.35	5.02
	Post-test***	4.71	5.23
I am able to construct scientific arguments.	Pre-test***	4.21	4.77
	Post-test*	4.65	5.01
I am good at science.	Pre-test**	4.58	5.00
	Post-test**	4.66	5.14

*** $p < .001$, ** $p < .01$, * $p < .05$

- For the science self-efficacy items, middle school students had *significantly lower* average agreement than high school students with the statement 'I am able to conduct peer review of other students' science research' (4.38 compared to 4.75) at pre-test only, narrowing the gap by post-test (4.85 compared to 5.09). At post-test, however, after only minimal change, middle school students had *significantly lower* average agreement than high school students with the statement 'I am able to analyze data to do science research' (4.76 compared with 5.19). The difference may reflect readiness for more advanced skills at the high school level.

- For the value of science items, high school students had *significantly higher* average agreement than middle school students with the statement 'I want to have a career in science someday' at both pre-test (4.47 compared with 3.87) and post-test (4.68 compared with 3.94). It is not unexpected that high school students would be thinking more about their future after graduation. At post-test only, however, middle school students had *significantly higher* average agreement than high school students with the statement 'being good at science is important' (5.51 compared with 5.20), although it had increased for both groups since pre-test.

Science Identity and Belonging

An important objective of the SRS is welcoming students into a diverse and inclusive scientific community. Although we have collected and reported on registration demographics in previous years, this year we sought to learn more about the students' sense of inclusion, representation, and belonging

during the SRS itself. For students as a whole, there was significant positive change on the statements, 'some scientists are like the people in my community,' 'people like me belong at the SRS,' and 'I am a member of GLOBE.' There was minimal change for 'people like me can be scientists,' although this started with a fairly high average rating between *agree* and *strongly agree* at pre-test. And there was change in the undesired direction for 'I enjoy meeting people who are different from me'; it is not clear from the comments or other ratings why this would be. (Table 6.)

Table 6. Average student agreement on science identity and belonging statements before (pre-test) and after (post-test) the SRS (n=164).

Student Pre-Post Survey Items: Science Identity and Belonging (all students)	**Average Agreement**	
Rating scale of 1 *strongly disagree* to 6 *strongly agree*	**Pre-test**	**Post-test**
1. Some scientists are like the people in my community.***	4.53	4.82
2. People like me can be scientists.	5.34	5.33
3. I enjoy meeting people who are different from me.	5.46	5.37
4. People like me belong at the GLOBE SRS.**	4.98	5.14
5. I am a member of GLOBE.***	5.03	5.32

*** $p < .001$, ** $p < .01$, * $p < .05$

Outcomes by Demographics

- URM students started with significantly lower average agreement than non-URM students on the statement 'some scientists are like the people in my community,' but the average agreement *increased more* for URM students than non-URM students from before to after the SRS, narrowing the gap to non-significance by post-test. Averages were all above the *slightly agree* level (4.0) and got closer to the *agree* level (5.0) by post-test, indicating an increasingly positive sense of representation. (Table 7; Figure 10.)

- For the statement 'people like me belong at the SRS,' there was not a significant difference at pre-test, but the average agreement among URM students *decreased* slightly from before to after the SRS while it *increased* for non-URM students. This resulted in a significant group difference by post-test with lower agreement among URM students. Still, all averages were near or above the *agree* level (5.0), indicating a fairly high sense of belonging across all students at both points in time. (Table 7; Figure 10.)

Table 7. Significant differences in average agreement on science identity and belonging statements between URM students (n=67) and non-URM students (n=96) at pre-test and post-test.

Student Pre-Post Survey Items: Differences in Science Identity & Belonging		**Average Agreement**	
Rating scale of 1 *strongly disagree* to 6 *strongly agree*	**Time**	**URM**	**Non-URM**
Some scientists are like the people in my community.	Pre-test*	4.32	4.67
	Post-test	4.74	4.89
People like me belong at the SRS.	Pre-test	4.99	4.96
	Post-test*	4.96	5.27

*** $p < .001$, ** $p < .01$, * $p < .05$

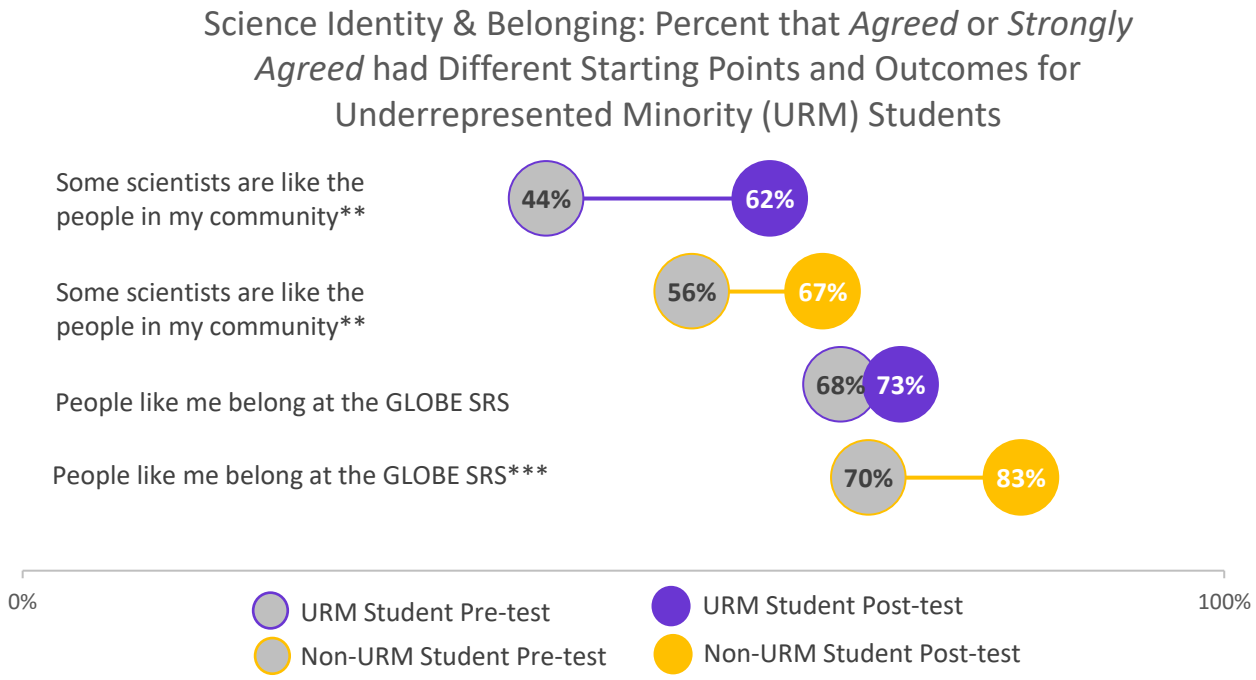


Figure 10. Percentage of students agreeing *or* strongly agreeing *with example science identity and belonging statements before (pre-test) and after (post-test) the SRS, by identification as URM student (n=67) or non-URM student (n-95).*

Grouping URM students and SRS events together may obscure cultural and socioeconomic differences in a way that makes it difficult to take informed action to address disparities. However, analysis at the event level or by a specific race or ethnic identity is challenging as the number of students within each group decreases. 'Statistical power' to detect significant differences and participant privacy become important considerations for both analysis and reporting. But we are continuing to explore these results internally to support the GLOBE U.S. Coordination Office in developing a plan with U.S. Partners and SRS event leads to improve the inclusiveness of the SRS for URM students.

SRS Impact in Their Own Words

In the SRS post-survey, we 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 166 responses, 140 (84%) indicated movement from negative or neutral to positive sentiment (138) or maintaining or increasing already positive sentiment (2) towards science, the SRS, or related experiences. **Responses indicating positive sentiment at the end of the events most frequently referenced finding the SRS more fun or interesting than expected (43).** Many students came into them thinking they would be "scary," "boring," "serious," "tense," or "intimidating," but left describing them as "fun," "interesting," "cool," "welcoming," and a "good experience," for example:

- "[I thought] it was going to not be that fun … it is very fun and educational."

- "I thought of … how I would be judged, [but now I know] that everyone's kind and is here to have a good time."
- "I thought the SRS would be boring … [now] I think that I want to come back!"
- "[I thought] it was just a gathering where we were going to present our project … we were provided with many activities and experiences that made it more enjoyable."
- "[I thought] it was like for super smart people and I wasn't gonna fit in … [but now I know] it's super fun and a very open environment."
- "[I thought] it wouldn't be interesting, I felt like it was something I had to do … it definitely isn't boring. I will be doing it next year."
- "[I thought] GLOBE was going to be a very tough, rigorous, and stressful competition with high stakes … [now I know it] provides a good experience for all students."

"[I thought] it was like for super smart people and I wasn't gonna fit in … [but now I know] it's super fun and a very open environment." —Student, Southwest SRS

"Before the SRS I was really nervous about presenting our project … but now I realize that even though I was nervous I was still able to present. I also realized our project has a large impact on other communities, not just ours." —Student, Northwest SRS

In addition to changes in perspective on the SRS in general, **some students found the research presentation less stressful or difficult than they anticipated (16)**.

- "[I thought] science research presentation was very scary and worrying … [but now I know] being prepared and well thought out makes me feel confident. The judges were fun to talk to and I learned so much."
- "Before the SRS I was really nervous about presenting our project … but now I realize that even though I was nervous I was still able to present. I also realized our project has a large impact on other communities, not just ours."
- "[I thought] I was going to be stressed out about presenting … [but now I know] that everyone likes learning new things and asking questions."
- "[I thought] presenting to other people [was] scary … [but now I know] it's not bad to interact with other people, it's pretty fun."

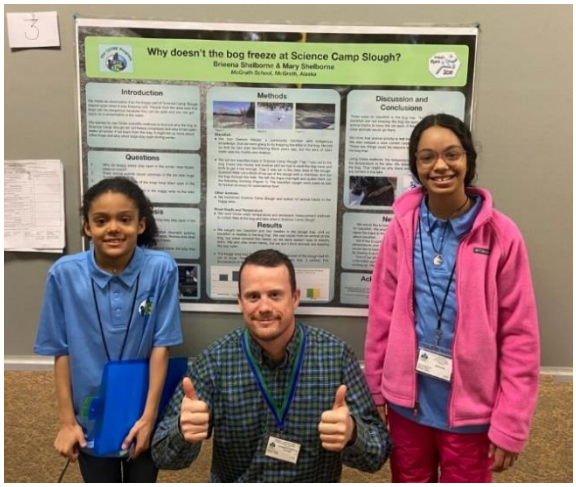
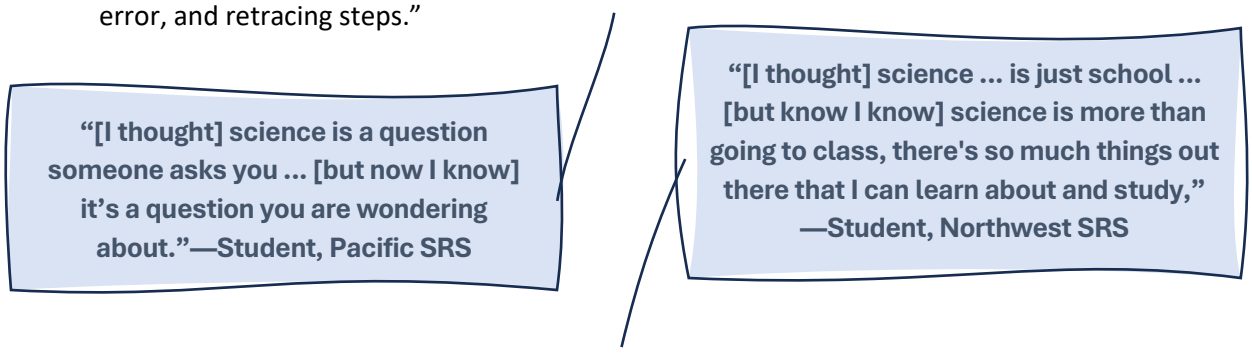


Photo: Northwest Regional SRS, University of Alaska, Fairbanks AK
Photo credit: S. Clement

Other students focused on the experience of participating in the GLOBE community at the SRS (14), referencing the opportunities to meet and interact with others interested in science. As one student described it, "[I thought] presenting your project to other students was not very important … [but now I know] that other students can really help you improve." Another thought "that people were going to be standoffish or think they are better than us," but found that "they are really nice." Others remarked "[I thought] I couldn't meet new people … [but] now I got a lot of friends," "[I thought] I was among few that enjoy science … [but now I know] many students enjoy science," and "I am not alone and other students like the same things as me!" Two focused on interactions with scientists. One of these thought that "scientists were a lot more closed off and hard to approach," but found "they are some of the nicest people," and the other thought "I could not talk to others about data," and learned that "scientists are open and welcoming to talk to me about my data."

In variations on a theme, students learned a range of new things about science, referencing changes in their understanding of what science is or what science research is like (11), their attitudes toward science (9), their beliefs about who participates in science (9), and their awareness about opportunities in science (6). Examples of each follow.

- **What science is or what science research is like (11):** "[I thought] that doing research meant I had to find a conclusion … [but now I know] that it can be open-ended," "[I thought that] it was much harder to construct a worthy experiment with very few resources and very many constraints … [but now I know] it is possible to create a valid experiment even with limited time and materials," "[I thought] science is a question someone asks you … [but now I know] it's a question you are wondering about," "[I thought that] the scientific process was very impersonal … [but now I know] that science is driven by personal interests, desires, and interactions," "[I thought] there was a specific order to the scientific process … [but now I know] it's full of trial, error, and retracing steps."



- **Attitudes toward science (9):** "[I thought] science was boring … [but now I know] it is super important and interesting," "[I thought] science is sooo dumb … and science is just school … [but know I know] science is more than going to class, there's so much things out there that I can learn about and study," "[I thought] I didn't like environmental science … [but now I know] it's more interesting than I thought and I'm interested in the process of gathering data," "[I thought] I wouldn't enjoy it and that Earth Science was the worst … [but now I know that] gathering the data was actually very fun and important for scientists."
- **Beliefs about who participates in science (9):** "[I thought] research was only for some age groups … [but now I know] research is accommodated to everybody," "[I thought] I wouldn't be good at conducting a scientific study … [but now I know] anyone, including myself, can do a

study. Having passion is all that matters," "[I thought] we had no place in the research process … [but now I know] we are key to research," "[I thought] scientific influences were mostly by adults … [but now I know] kids can also be in scientific projects that help the globe," "[I thought] only very smart people can test scientific ideas … [but now I know] anyone willing to learn and is interested in science can do it."

"… [Now I know] kids can also be in scientific projects that help the globe." —Student, Southwest SRS

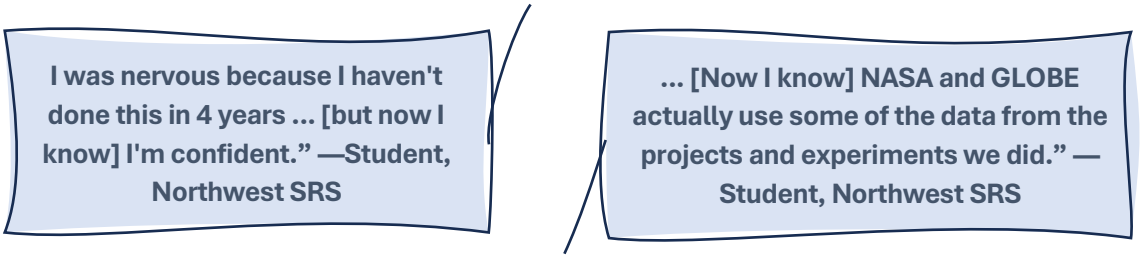
"[I thought] there were not many jobs in science … [but now I know] there is so much that you can do with science." —Student, Midwest SRS

- **Awareness of opportunities in science (6):** "[I thought that] environmental science wasn't really taught at universities … [but now I know] from the [University of Wisconsin – Madison] brochure, environmental science is an academic program," "[I thought] there were not many jobs in science … [but now I know] there is so much that you can do with science," "I didn't realize how many science opportunities there are and that I could pick basically anything to research scientifically … [but now I know] there's pretty much no limit to science," "[I thought that] [University of Alaska – Fairbanks] was not very big and there was not a ton of jobs about snow … [but now I know it] is huge and there are so many jobs for studying snow!!"

Photo: Pacific Regional SRS, Elkhorn Slough National Estuarine Research Reserve, Watsonville CA

Students also gained specific science knowledge at the SRS (8), such as "I thought that a [Secchi disk] was something you threw across the water … now I know that it's used to measure how dirty the water is," "before the SRS I thought wildfires didn't affect cloud accumulation … [but now I know] CO2 released from wildfires and other things can affect cloud accumulation and the type of clouds that form," "[I thought] the top of the snow was clean … it is not clean at all," and "[I thought] some processes were simple and just that … [but now I know] that when going more in depth everything has a meaning and a job, like trees and ecosystems." **Some learned other lessons (8),** like "to not think things are going to be boring before actually doing it," that it is "important to learn more," and "what a symposium is." Another student at the Northwest SRS "didn't know a lot about Alaska Native culture," and learned that "people ask the Elders about a lot."

The SRS increased some students' confidence to do science and participate in science activities (10), for example, "[I thought] I couldn't do a lot of sciency [*sic*] stuff … [but now I know] I can do it," "[I thought] 'this is weird, why am I here' … [but now I know] that I never should have said that," "I thought I wouldn't be able to do this … now I know everyone can be a scientist," "[I thought] that I was not interested/capable of being interested in science and analyzing data … [but now I know] I actually love going over data and figuring out scientific questions," "[I thought] that I'd never do something like this … [now I know] that I can and I have," and "[I thought] that I was unable to present and carry out such a large scale project … [but now I know I am capable and can do more than I thought." One student described how the boost in confidence was particularly needed after the pandemic SRS gap, saying "I thought I wasn't going to do good, and I was nervous because I haven't done this in 4 years … [but now I know] I'm confident."



Other students gained awareness of NASA and GLOBE (6), for example, "before [the] SRS I thought they had nothing to do with snow packs, or climate change … [but now I know that GLOBE] does A LOT of research about climate change in Alaska and NASA collects data from snow," and "[I thought] the SRS was only held to get kids into science, but didn't really care about the projects or data … [but now I know] NASA and GLOBE actually use some of the data from the projects and experiments we did." Students learned that NASA does not only "launch rockets" but also "does a lot of environmental things," uses "their space program to collect data on and research other things as well, such as our environment," and that "trees are an important data point for NASA."

Responses within the theme of event expectations and preparation ranged across every combination of pre-post sentiment except negative to positive, with most coded as neutral to positive (8), neutral to neutral (7) or unclear (8). These focused mainly on specific aspects of the SRS event. As an example for each coding pair respectively, "[I thought] there were going to be a lot of people … [but now I know] that it was very fun and I would do it next year," "[I thought] there would be less people … there was people from at least two different states," and "[I thought] that it would be a competition … [but now I know] that it's not."

Of the responses not coded as positive after the event, most were coded unclear (15) or neutral to neutral (8), and in only several cases negative to negative (2) or positive to negative (1).

Student Enjoyment of the SRS

In the post-SRS survey, we asked students to select what they ENJOYED MOST about the SRS from a checklist of 12 event components (including two slots for *others*). One hundred seventy-four students made a total of 795 selections, averaging over four selections each. **Field trips or tours was selected by the greatest percentage of students (77%) as the component they ENJOYED MOST, followed by hands-on science activities (64%), meeting scientists (60%), and meeting other students (55%).** By a wide margin, the keynote speaker and opening remarks received the fewest selections (13%). We also asked students what they ENJOYED LEAST using the same checklist, and 127 students made 229 selections, averaging fewer than two selections each. Largely and predictably, the components ENJOYED MOST by a greater percentage of students were ENJOYED LEAST by a lower percentage and vice versa. However, research presentations to other students was the most divisive component with the smallest difference between the percentage of students who enjoyed it MOST (36%) and LEAST (32%). (Figure 11, p. 32.)

Photo: Midwest Regional SRS, University of Wisconsin, Madison WI
Photo credit: D. Johns

Students were asked to describe what they ENJOYED MOST about the SRS and WHY, and 169 provided substantive responses. Their descriptions included 90 references[9] to specific or general field trips and tours (51) and activities (39). Nineteen students who attended the Northwest SRS described their tour of the University at Alaska Fairbanks (UAF) college campus and Museum of the North, frequently expressing an interest in attending UAF in the future, for example, "I mostly liked … the UAF college tour. So much opportunities in college that sounds interesting," "I liked the tour best because I got to see what things you could do at UAF," and "the thing I enjoyed the most was the UAF campus! It was really eye opening and made me more excited for college and pursuing a degree." Thirteen students from the Midwest SRS described their tour of the Cave of the Mounds led by the Geological Survey and University of Wisconsin Geoscience Department. Four noted they had never or rarely been to a cave before in comments such as "I enjoyed the cave tour the most because I found it very interesting and it was my first time in a cave," and "I enjoyed the cave because it was very cool and informative. This was one of my first times in a cave." Others referenced specific experiences on the tour such as "I liked the cave the most because you could see how it formed over time," and "my favorite part would have to be

[9] Descriptions frequently referenced more than one aspect of the SRS, so the total number of references (223) exceeds the total number of substantive responses (169).

the tour in the cave because of the differently colored rocks." Seven students from the Midwest SRS described their boat ride on Lake Mendota, for example, "I really enjoyed the boat [ride], it was a new experience," and "[I most enjoyed] when we collected stuff from the lake and saw it up close."

> **"The thing I enjoyed the most was the UAF campus! It was really eye opening and made me more excited for college and pursuing a degree."**
> **—Student, Northwest SRS**

> **"I enjoyed doing the hands-on activities because I felt like a scientist out there and I enjoyed talking to professionals who work in the area I want to work in."**
> **—Student, Pacific SRS**

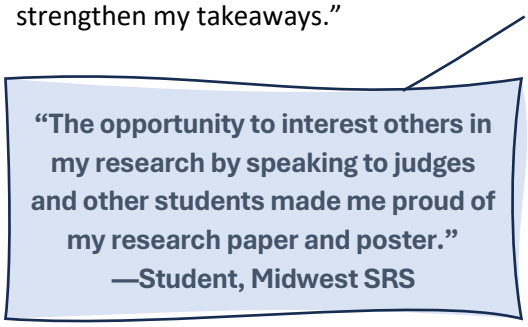
Many references to hands-on activities were more general, such as, "hands-on activities because it is fun to get out there and do different things," "I enjoyed most doing hands-on science activities, because it was fun and helped me gain more knowledge by doing it myself," "I enjoyed doing the hands-on activities because I felt like a scientist out there and I enjoyed talking to professionals who work in the area I want to work in," and "I enjoy the hands-on science activities as I was able to talk and meet other students and also get different experience." Specific activities referenced include hiking (3) which one student described as "just being in nature, in the moment of things" (3), crab catching (3), geocaching (3), lab work (2), drumming (2), walking on the beach (2), a drone activity (1), and a trivia night (1).

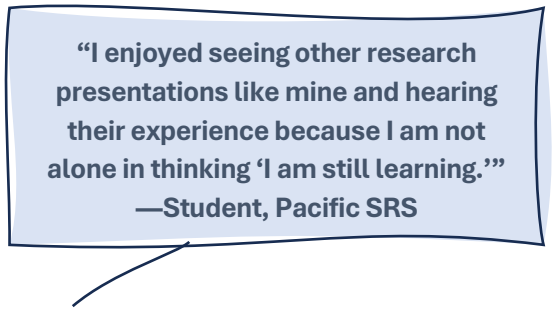
Photo: Midwest Regional SRS, University of Wisconsin, Madison WI
Photo credit: D. Johns

Fifty descriptions referenced the presentations, both presenting (37) and seeing other presentations or the presentations in general (13). Those who most enjoyed presenting describe the opportunity to showcase their work, build their skills and confidence, and get constructive feedback, for example:

- "I liked presenting because it gave me a chance to showcase my hard work."
- "I enjoyed presenting. It was good practice and I liked sharing my research."
- "It ignited a confidence within myself that I often do not have when presenting."

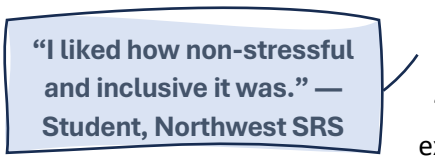
- "Getting the opportunity to present my work to such amazing people and working with my group to do so."
- "The opportunity to interest others in my research by speaking to judges and other students made me proud of my research paper and poster."
- "I liked presenting our poster and getting reviews the most. The reviews gave us things that we could do to make our project/presentation better."
- "I really appreciate the support and feedback of the scientists. I felt like it helped me to strengthen my takeaways."





Those who most enjoyed seeing other presentations appreciated the opportunity to learn about how other students approached their projects and connect with other students interested in science, for example, "I enjoyed reviewing the other students' posters and becoming inspired and getting ideas for a potential project next year," "I enjoyed learning that science is more than school. Seeing that other people are serious in their projects and have learned many new things is a great experience," and "I enjoyed seeing other research presentations like mine and hearing their experience because I am not alone in thinking 'I am still learning.'"

Meeting other people was also a frequent reference in the descriptions (49), in general (30), meeting scientists specifically (10), or meeting students specifically (9). Students described the experience of "meeting new people who also like science," "meeting the community and getting feedback," and "meeting like-minded individuals and learning from my peers." One student enjoyed "meeting people from all over," and another noted that meeting others "allowed me to make connections." Those who referenced meeting scientists specifically "enjoyed meeting scientists and learning from them" and "enjoyed meeting the NASA scientists," with another explaining, "I liked getting to go and see how there is science all over, and how scientist do their jobs." Regarding meeting other students, they "most enjoyed meeting other kids and seeing how many other students are interested in science," "meeting and hearing about other students' passions," and "made lots of friends." One student's "favorite part about the SRS was getting a chance to travel to new places and share my research with other students."



Other aspects of the SRS students enjoyed include the "opportunity to learn all this new stuff, being able to expand my knowledge," "getting to see things I may not have gotten to see," "the different experiences it gave me and how there was a variety of things we did throughout," "being able to conduct experiments because they pushed me to think of my own inquiries," "making applications to my community," and "how non-stressful and how inclusive it was."

Students were also asked to describe what they ENJOYED LEAST about the SRS and WHY, and 160 provided substantive responses. However, 36 of these stated there was NOTHING they did not enjoy.

For example, “none. Everything was super fun,” and “nothing. I could not make up my mind because everything was awesome,” and “nothing. It was all great! 😊” **Among those students that did actually enjoy something least, it was most frequently their own anxiety (40), whether presentation anxiety (19), general anxiety about the event (11), or social anxiety (6), which in some cases improved over time (4).** Students described how they “enjoyed least research presentations to the reviewers because I was nervous,” “hate speaking in front of people,” and “have stage fright so I get kinda scared.” One student explained, “I’m very shy and have social anxiety so this was kind of hard for me.” Some who were anxious found the experience not as difficult as anticipated though, for example, “meeting people is stressful but it was not bad,” and “I did not really enjoy the actual presenting of our projects because I am shy and was very nervous but it turned out well.” One student described how the peer review “helped my nerves for sure but I feel it was harder presenting to students than scientists.” An additional five students reported that they least enjoyed presenting without referencing any anxiety.

The next most frequent references were to the opening remarks and keynote speakers (20). Some students described getting restless sitting and listening, for example “I didn't like sitting and listening because I really wanted to do hands-on stuff,” “sometimes people got a little bit long-winded. I don't enjoy sitting and listening to people talk for a large amount of time.” Others just wished for less of a good thing, saying “I LEAST enjoyed the keynote speaker because what they were saying was interesting but it was too long,” and “I felt as if the opening remarks took too much time.” Still others focused on the choice, content, and delivery of the speakers, saying “the speaker was honestly very boring and not engaging,” “during the keynote speaker I felt like I was just hearing things that I’d heard before many times,” “I had no idea who the [speaker] was, a more relevant speaker might’ve been nicer,” and “I felt that the scope of the speakers' topics were fairly limited and not as relevant as they could be.”

Twelve students least enjoyed the peer reviews because they felt the peer reviewers “did not listen,” reporting that “not many of them asked questions or engaged in the topic we were talking about,” and “none of them asked good questions.” Relatedly, four students least enjoyed meeting other students because “they were all young and not my age,” “noisy kids,” “annoying,” and “disengaged from the activities.” Ten students were disappointed that some of their expectations were not met, particularly around meeting other students, for example, “I feel like there wasn't as much collaboration and socializing between different groups and schools as there could've been. The only new people that I really met were adults,” “we didn’t really meet students who were our age,” and “it was small. I was expecting a much larger event in terms of people.” The comments also indicate that at one event, some students did not have the opportunity to present their posters for peer review.

Eight students experienced challenges related to the schedule or organization of the event, such as “at times, our group felt rushed in the activities that were scheduled one after the other,” “there was a mix up where we didn't have enough reviewers and were waiting for a long time,” “I least enjoyed waiting because it's boring,” and “I feel like the compact schedule was efficient, but didn't give students the freedom to explore what they individually wanted to.” Another eight students least enjoyed the activities, with some finding them “unstructured,” “not the most interactive,” “not engaging enough,” and “disconnected and didn’t relate to the symposium.”

A total of 15 students least enjoyed various physical discomforts such as being cold (5) or tired (3) or walking a lot (7) in some cases while cold and/or tired too. Outdoor activities led to one student least enjoying “honestly just being outside with wet socks” and another feeling concerned about ticks. Two

students least enjoyed the food. Other aspects individual students enjoyed least include “everyone got my name wrong,” “this is all new to me,” and “there was a lot of handholding and not a lot of natural discovery, also it felt like there was a lot of talking down or oversimplifying ideas.” One student noted that “There was a huge skill-gap in the beginning, but with the peer-to-peer review, the gap lessened.”

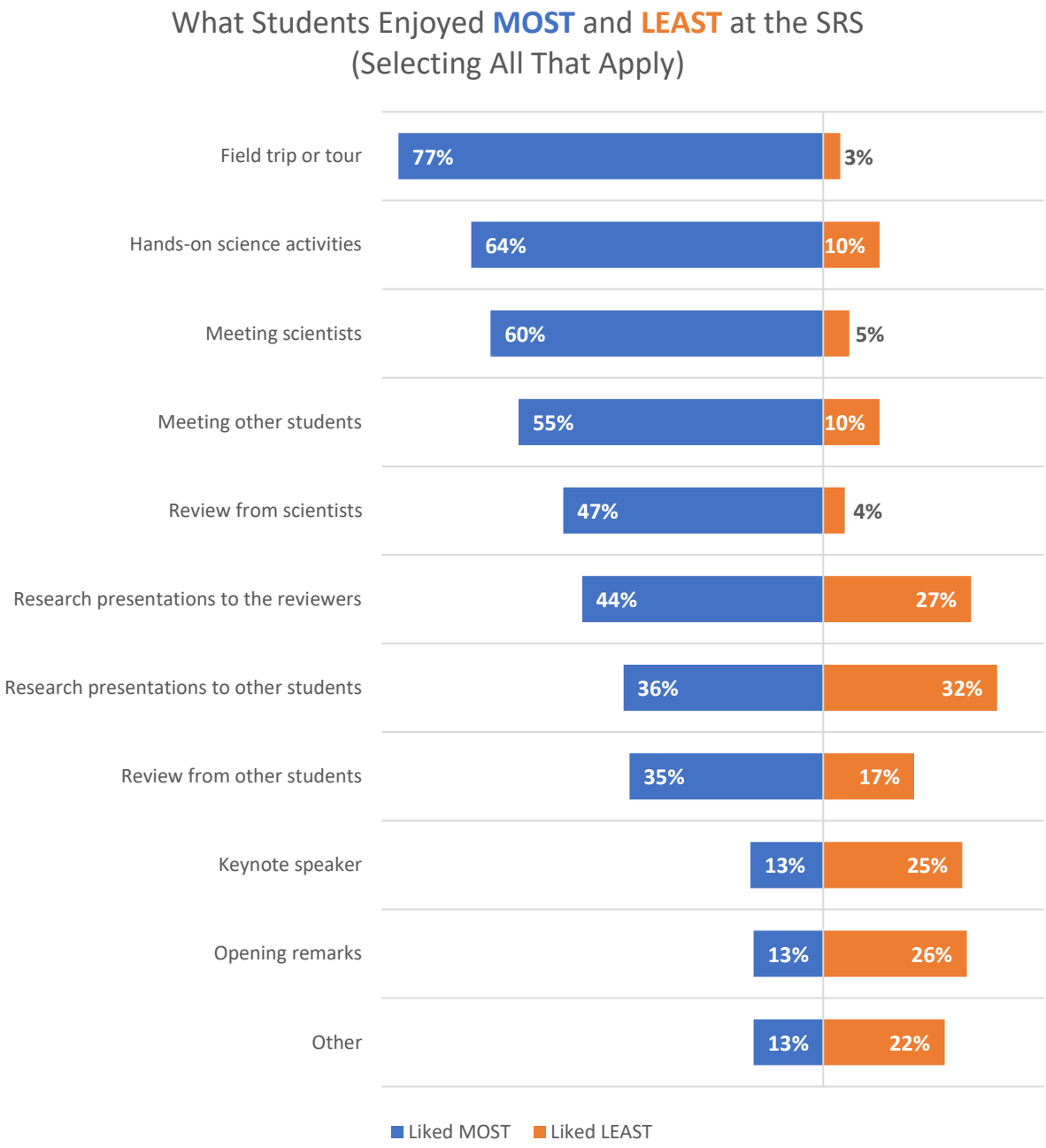


Figure 11. What students enjoyed MOST *and* LEAST *at the SRS (n=178). In total 174 students made 795 selections for what they enjoyed* MOST*, and 127 students made 229 selections for what they enjoyed* LEAST*.*

Educator SRS Participation and Outcomes

Fifty-two educators participated in the 2023 Regional SRS. Forty-nine (49%) completed a registration survey which provided data on their demographics, background in education, learner population, GLOBE research projects, and previous SRS participation. Of these, about half (49%) reported that 2023 was their first GLOBE SRS. A third (33%) had participated in one Regional or Local SRS before, and the remainder (16%) had participated in two or more. More educators had previously participated in the 2022 Local SRS (35%) than in the 2016-2019 Regional SRS (22%); 27% had *only* previously participated in the 2022 Local SRS. The data cannot explain if this is due to the greater accessibility of the Local SRS events or the fact that that they were held more recently—or to other unknown factors.

Of the 52 participating educators, 42 (81%) completed the post-event survey. The survey included questions to assess educator outcomes related to facilitation of science learning, use of GLOBE resources, and satisfaction with SRS and professional development activities. (See Appendix A.)

Educator Characteristics

Educators most frequently identified their gender as female (69%) and their race/ethnicity as White (76%). Selections for race/ethnicity also included Asian; Black or African American; Hispanic, Latino/a/x, or Spanish origin; and Native American or Alaskan Native. Their teaching experience ranged from 1 to 31 years. More than half (57%) have been teaching for more than 15 years, and the remainder evenly split for 6 to 15 years (21%) or less than five years (21%). Selecting as many grade bands as applied, most educators reported working with learners in grades 9-12 (71%), next grades 5-8 (50%) and finally grades K-4 (31%). Twenty percent (20%) reported working with learners of all grades K-12. Educators were asked what subjects they teach in their schools and programs, again selecting all that applied. Environmental science was the most frequently selected (22), with biology (19), general science (16), and earth science (16) as the other frequently selected subjects. These were followed by physical science (12), chemistry (9), general mathematics (9), and physics (5). Twenty educators also chose other subjects or roles, such as engineering, forensic science, and school administration. (Table 8.)

Table 8. Subjects taught by educators attending the SRS, selecting all that apply (n=49).

Subject	Selected	Subject	Selected
Environmental Science	22	Chemistry	9
Biology	19	General Mathematics	9
General Science	16	Physics	5
Earth Science	16	Other Science	15
Physical science	12	Not related to STEM	4

Nearly half of educators (48%) reported that learners conducted their GLOBE research projects in school, 27% reported out-of-school, and 25% chose other, with almost all of these stating that the projects were conducted both in and out of school. The majority (61%) reported that their learners interacted with a GLOBE mentor at least once (in person or virtually) for their research project.

Educator SRS Outcomes

All responding educators (100%) reported that participating in the SRS improved their ability to integrate science research in their classroom or program. Many educators commented on their ability to

incorporate new ideas, technology, and resources (13) and that the SRS allowed them to engage learners in research that was relevant to them (12). For example, one remarked that the projects "encourage students to take ownership of science exploration," and another that the SRS "gave students a goal to work towards. Once they decided what they wanted to explore, they took off." A third described how "it really opened our eyes to the possibilities that exist for content integration. The activities as well as student projects opened many new avenues for exploration."

"The SRS gave students a goal to work towards. Once they decided what they wanted to explore, they took off." —Educator, Southeast SRS

"It really opened our eyes to the possibilities that exist for content integration. The activities as well as student projects opened many new avenues for exploration." —Educator, Northwest SRS

Other educators commented on the interactions they and their learners had with the GLOBE community and process (8). One reflected that "Interaction with other educators and scientists always sparks new ideas," and another commented, "during [the] presentation, [reviewers] brought up questions that were valuable to [the] kids' project." Several educators praised the GLOBE program and its clear protocols and framework (8), such as, "it gave me a great framework, easily accessible as a new educator, to construct projects off of," "protocols will allow me more activities in future class use," and "protocols work well and offer a guide that is easy to work with."

Mirroring the new addition to the student survey, educators were asked to what extent they agreed that doing a GLOBE project during the year helped them to facilitate their learners' skill development, rating their agreement on a scale of 1 *strongly disagree* to 6 *strongly agree*. Overall, educators *agreed* that GLOBE projects helped learners build skills in each of the listed areas. The highest-rated areas included making observations and recording dating (5.66/6.00), collaborating on a group project (5.64/6.00), and communicating the outcomes of their research investigations (5.64/6.00). The lowest-rated areas were explaining the reasoning behind an idea (5.28/6.00), considering alternative explanations (5.10/6.00), and identifying references and citations (4.90/6.00). (Table 9.) The educator observations in learner skill development echo the viewpoints of the learners themselves. For example, making observations and recording data, working together as a group, and writing about what was observed and why it happened were also among the top rated skills from the learners' perspective.

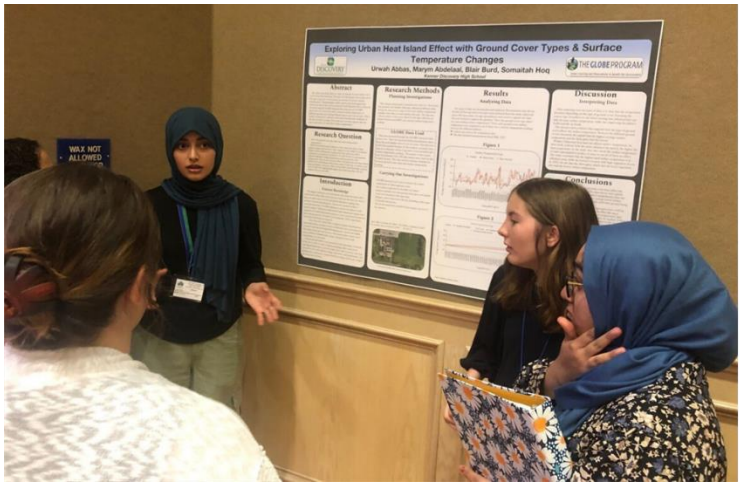


Photo: Southwest Regional SRS, University of Texas, Tyler TX
Photo credit: M. Odell

Table 9. Average educator ratings of agreement that doing a GLOBE project with the students in their class or program helped to facilitate their skill development in each of the following areas on a scale of 1 strongly disagree *to 6* strongly agree *(n=39).*

Skill Development Area	Average Rating	Skill Development Area	Average Rating
Making observations and recording data	5.66	Connecting a project to issues in their local environment or community	5.38
Communicating the outcome of their research investigations	5.64	Analyzing relationships using charts or graphs	5.33
Collaborating on a group project (e.g., communicating, resolving differences, being reliable, supporting others)	5.64	Choosing variables to investigate	5.31
Generating questions or predictions to explore	5.51	Adjusting to changes in the course of a project as needed	5.29
Designing or implementing their own investigations	5.49	Explaining the reasoning behind an idea	5.28
Supplying evidence to support a claim or explanation	5.46	Considering alternative explanations	5.10
Organizing data into charts or graphs	5.38	Identifying references, citations, and acknowledgments of others in their research	4.90

We also asked educators to tell us in their own words the most significant outcome for their class or program of doing a GLOBE project. Themes in their statements included (alone or in combination) students gaining interest, engagement, and confidence in science (14); learning specific science research skills (13); communicating their results to others (13); and connecting with other students and building community (10). Educators found it significant that students were "seeing science in practice and real world applications," "collaborating around an authentic relevant problem," "connecting a meaningful project to our community, while applying the science we are learning in school," "gaining confidence in their ability as independent researchers," and that students were doing "place-based science that is authentic and meaningful and can be shared!"

Some described specific outcomes of participation, such as making the GLOBE community 'real' for students, engaging them in the complete scientific process cycle, and helping students recognize that they can contribute to scientific research, among others, for example:

- "The students are now aware and know other students who do GLOBE. I always say it. But now it is real for them."
- "Meeting and networking with like-minded students and getting recognition for research."
- "They were able to work as a team of students and practice public speaking while exploring a new place away from home."

- "They're able to complete the scientific process from start to finish. My favorite is that they're able to share their findings and develop professional communication skills that they will use in other areas in the future."
- "Introducing participating students to GLOBE protocols and making connections [to] data and community needs involving the effects of global climate change."
- "Presenting their research to scientists and seeing that they have ideas and data to contribute to the scientific community."
- "I think the biggest takeaway was that doing science and being part of a large scale data collection program isn't for other people. It's for them ... they can be scientists!"

"The students are now aware and know other students who do GLOBE. I always say it. But now it is real for them." — Educator, Northwest SRS

"[The students are] presenting their research to scientists and seeing that they have ideas and data to contribute to the scientific community." —Educator, Pacific SRS

One educator who attended as a chaperone became interested in getting involved in GLOBE as a result, explaining "I was not involved in this year's project, I am just a chaperone. That being said I am curious for the opportunity next year. The process was not nearly as hard as I imagined." Another described multiple outcomes of long-term engagement with GLOBE:

- "Combining the community with the school. Inspiring a student to go to college—first grad from our school to go to university! Teacher retention—I stayed for 10 years in a high turnover high needs remote school because I had this citizen science opportunity that continued over time. And collaboration of [peers] and assistance from GLOBE and UAF Researchers."

Use of GLOBE Resources

Educators were asked about their and their learners' use of GLOBE resources prior to the SRS. They could select as many resources as applicable. Educators predominantly used the consultation and support from their local GLOBE Partnership (81%), the emails from the U.S. GLOBE office (57%), and the science practices resources pages on the internal GLOBE SRS webpages (45%). According to the educators, their learners also most frequently used the consultation and support from their local GLOBE Partnership (45%) and the science practices resources pages on the internal GLOBE SRS webpages (38%). While the GLOBE Watercoolers (informal virtual discussions), educator blog posts, and mentorship with a STEM Professional from the GLOBE International STEM Network were not as widely used by either educators or learners, there is interest in utilizing those resources in the future. (Figure 12.)

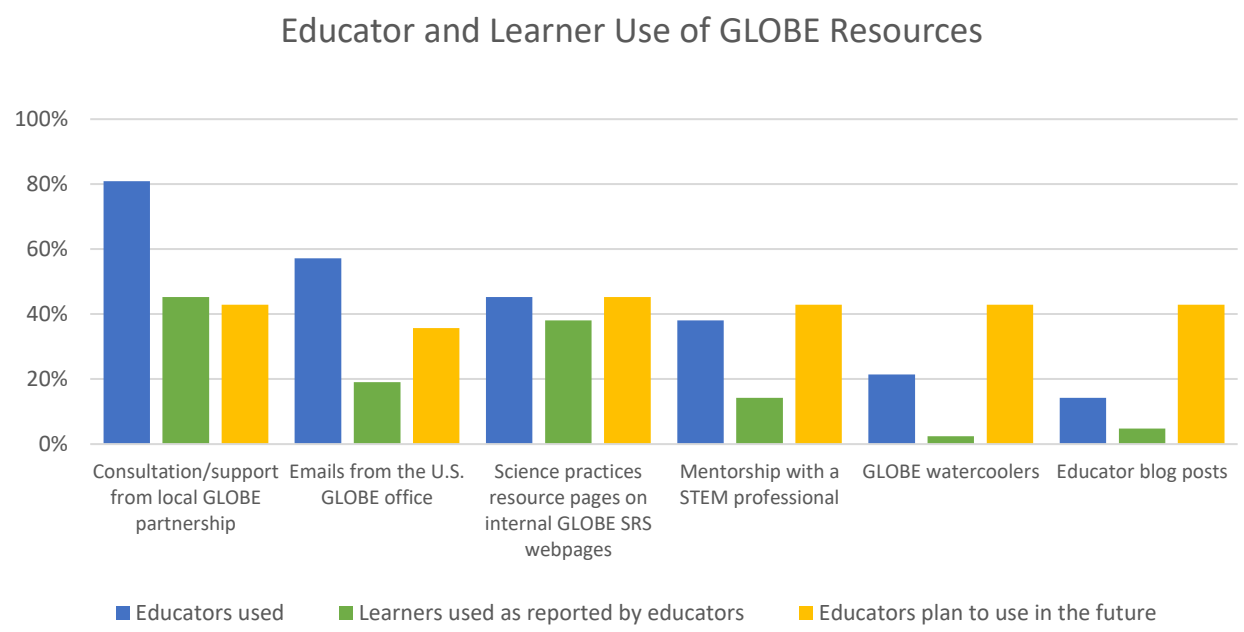


Figure 12. Educators report on their own and their learners' use of GLOBE resources (n=42).

When asked about how GLOBE can improve the content, quality, and accessibility of educator resources, multiple comments (9) provided positive feedback on the resources as they are, for example, "everything was fantastic. So happy with this program," and "I am not sure as I am new to GLOBE. So far, everything has been great." Suggestions for improvement included more information or training on the resources (9) and increased communication and ways to connect with other educators (6). Some educators found the resources challenging to navigate (6), and one mentioned a lack of reliable internet and electricity in their area as barriers to accessing the resources.

- "Maybe send out seasonal emails with all types of resources outlined—I personally did not know there were blogs or resources other than data viewing on GLOBE website."
- "Website is complex and hard to navigate. A tutorial on the homepage might help. "
- "I would really like ways to connect with researchers that are closer to me (not in Alaska). I think this would make GLOBE and authentic science more accessible for all my students."

Educator Satisfaction with the SRS

Educators were asked to rate their satisfaction with various aspects of the SRS events on a scale of 1 *very dissatisfied* to 6 *very satisfied*. (Figure 13.)

- Ninety-eight percent of educators were *very satisfied* (86%) or *satisfied* (12%) or with the SRS overall for themselves, and 97% were *very satisfied* (83%) or *satisfied* (14%) for their learners.
- Almost all educators were either *very satisfied* or *satisfied* with aspects of the event logistics, including the location (100%), venue (98%), and schedule (98%).
- Other aspects of the SRS that received high satisfaction ratings from educators include student research presentations to reviewers (93%), student research presentations to other students (93%), and hands-on science activities (93%).

- Aspects of the SRS receiving relatively lower (yet still fairly high) satisfaction ratings were representation of scientists who look like people from learners' home communities (79%), cultural relevance for the learners (76%), peer review from other students (74%), and the keynote speaker (72%).

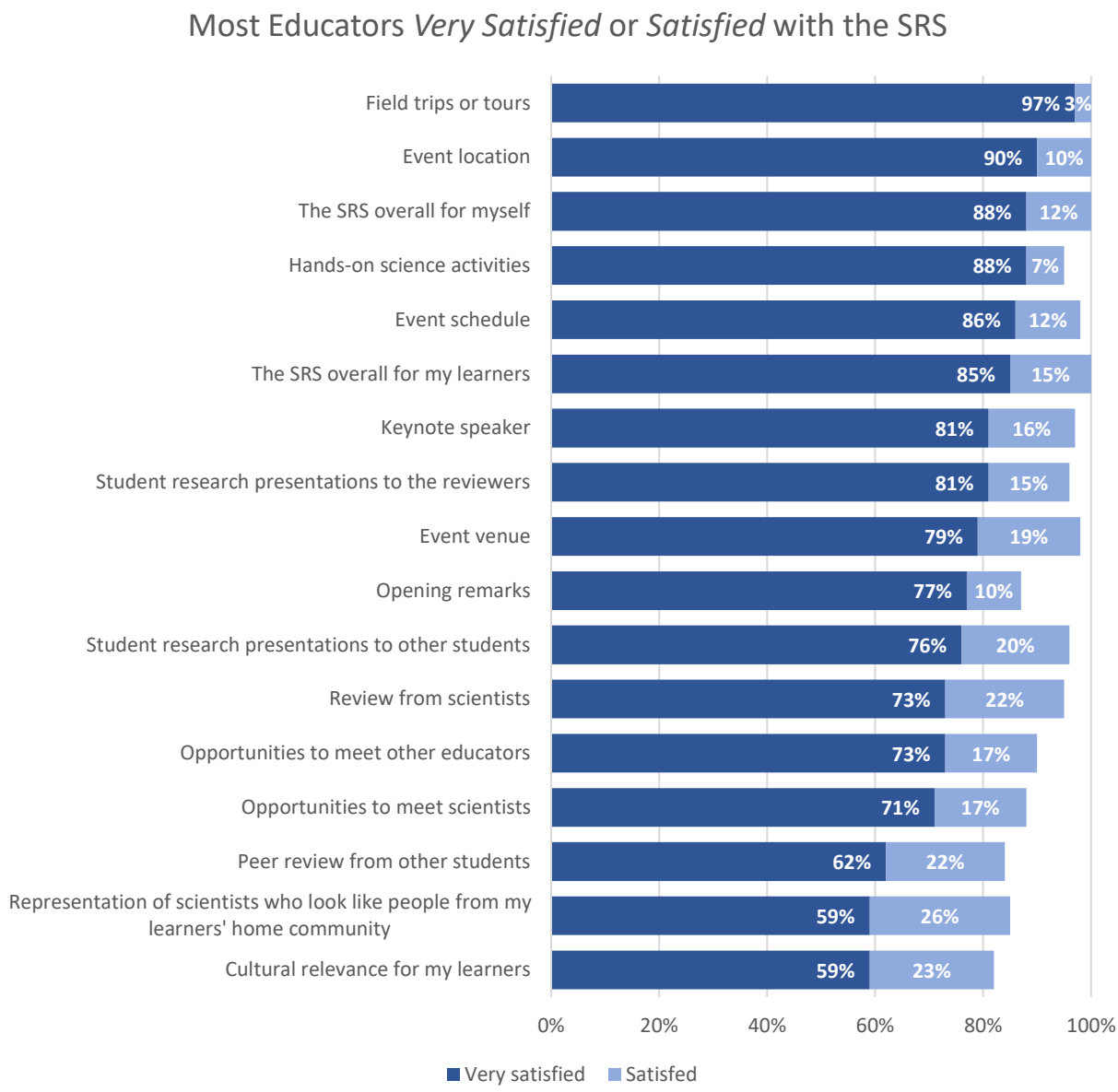
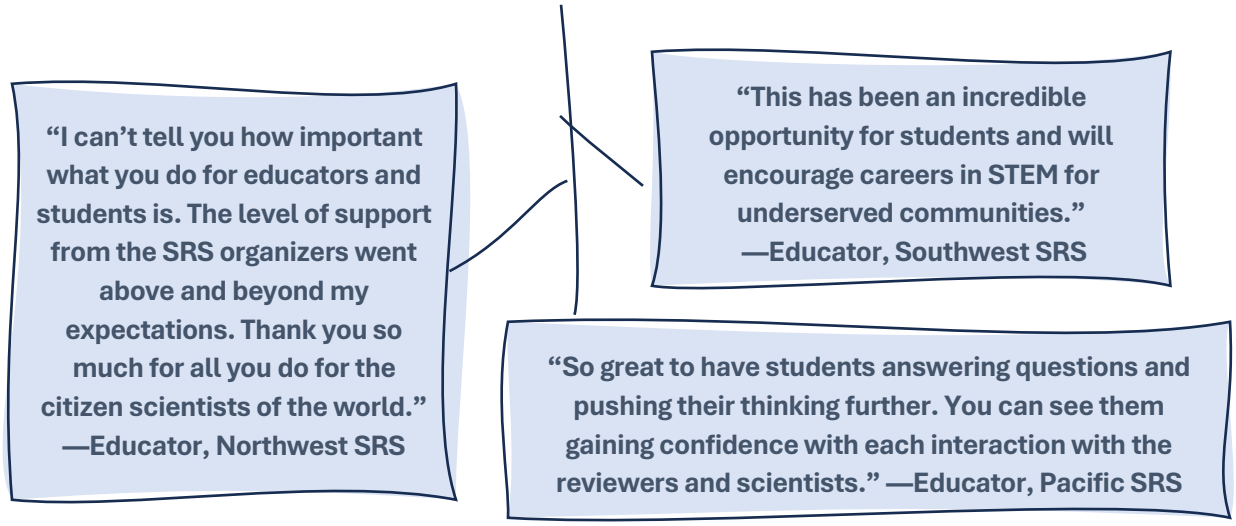


Figure 13. Percentage of educators very satisfied *or* satisfied *with aspects of the SRS (n=42).*

When asked to explain their satisfaction level, all responding educators praised the SRS; two wished they could have brought all of their learners. Multiple educators commented on the positive experiences their learners had at the SRS.

- "It is great to put children in the atmosphere of cultural leaders and scientists."

- "I can't tell you how important what you do for educators and students is. The level of support from the SRS organizers went above and beyond my expectations. Thank you so much for all you do for the citizen scientists of the world."
- "It was very well organized and provided amazing opportunities my students wouldn't otherwise [have] experienced."
- "This was an amazing opportunity for my students … to step out of their comfort zone and meet new people along with do new things."
- "This has been an incredible opportunity for students and will encourage careers in STEM for underserved communities."
- "This has been a very energizing and enlightening experience for me and my students."
- "So great to have students answering questions and pushing their thinking further. You can see them gaining confidence with each interaction with the reviewers and scientists."
- "I am very satisfied with our experience at the SRS. The students were engaged and learned about additional protocols they could explore when they get home."



Educators believe the SRS event logistics could be improved by improving the scheduling (9), such as consideration for travel and scheduling the event sooner. Some educators recommended having a mixer or social time for the learners to meet their peers from other schools (4) or planning an activity that allows them to explore the host city (2). One educator recommended having smaller rooms for presentations or fewer students presenting at one time to reduce noise and distraction.

Professional Development

Twenty-five of the 42 educators (59%) reported participating in a professional development activity at the SRS. They were asked to rate their agreement with four statements about their experience from 1 *strongly disagree* to 6 *strongly agree*. The educators generally rated their professional development experience very highly, with all average ratings falling between 5 *agree* and 6 *strongly agree*:

- The trainers were knowledgeable. (5.84)
- The materials were helpful. (5.68)
- Overall, this GLOBE training was valuable and worthwhile. (5.64)
- The training structure provided ample time for hands-on experience. (5.13)

Asked how GLOBE could improve the professional development experience, many providing feedback responded positively to the current professional development (9). One educator noted, "More – more – more – I love the ongoing support and assistance – I could not [have] done anything without the ongoing support and feedback and care of the GLOBE team." Other educators reported they would like more professional development time (5) and requested more resources, support, or feedback (2). Two educators mentioned specific staff members that positively impacted their professional development experience. Another educator stated, "Since I have completed all the e-learner educator training I would have liked something for a GLOBE educator that wasn't in the slide decks."

Reviewer Survey Results

The following section presents the results of the reviewer survey to assess satisfaction and collect feedback to improve the GLOBE SRS events for future reviewers. Additionally, the survey collected reviewer demographic information to gauge the diversity of STEM Professionals engaged in GLOBE SRS events. The survey was conducted electronically via Qualtrics in June and July 2023 after the SRS events had taken place. Forty-four reviewers participated in the SRS and 16 completed the survey for a 36% response rate. Given the low response rate, potential identifiers such as demographics or event location have been withheld to maintain respondent confidentiality. Additional information about the reviewer survey sample can be found in Appendix A.

Characteristics of the Reviewers

Improving the diversity and representation of STEM Professional reviewers is a goal of the GLOBE SRS. To that end, respondents were asked for information on their gender identities, racial and ethnic identities, social identities, and lived experiences. Of the 16 reviewers who completed the survey, 56% identified their gender as female, and 44% as male. Selecting all that applied, most reviewers (69%) identified their race/ethnicity as White. Other selections for race/ethnicity identification included Asian; Hispanic, Latino/a/x, or Spanish origin; Middle Eastern or North African; and Native American or Alaskan Native. Over a third (38%) of respondents were first-generation college students, and over two-thirds (69%) are parents or guardians. Reviewer representation also included having English as their second language, being an immigrant, identifying as LGBTQA+/non-cisgendered/non-binary, and living with a disability or identifying as a disabled person.

A majority of reviewers (63%) had previous experience as a reviewer at GLOBE events, with three respondents having served three or more times over the years. Additionally, 69% of reviewers had served as reviewers at other science events for K-12 students. The respondents serve in a variety of professional and volunteer roles, including GLOBE Partners (3), professors/faculty (3), and others (7), such as a K-12 teacher, a graduate student, a professional/industry scientist, and retired educators.

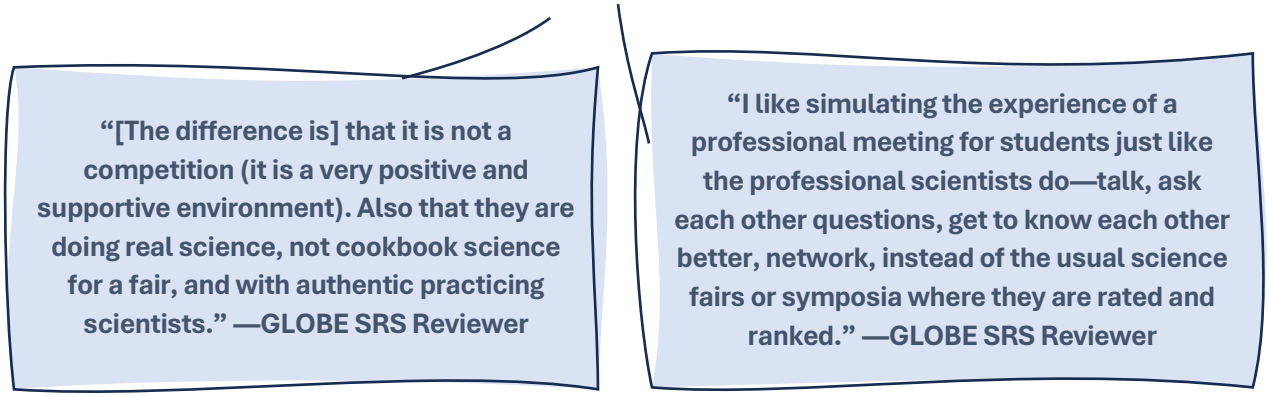
The GLOBE SRS Difference

Reviewers were asked if there was anything about GLOBE events that differed from other science events for K-12 students. Eleven respondents provided answers about how GLOBE is unique, including three who liked that the GLOBE SRS were not a competition. One of these explained, for example:

- "I like simulating the experience of a professional meeting for students just like the professional scientists do—talk, ask each other questions, get to know each other better, network, instead of the usual science fairs or symposia where they are rated and ranked. It is OK to rate their work

against a list of criteria, but hard when they are ranked against each other and competition is emphasized, which we don't do in the GLOBE SRS."

- "That it is not a competition (it is a very positive and supportive environment). Also that they are doing real science, not cookbook science for a fair, and with authentic practicing scientists."



Other reviewers praised the students' engagement with science and felt the GLOBE events to be a higher quality experience than other student science events, for example:

- "GLOBE events are more about learning, collaborating, and networking. I find this to be more inspiring and true to the purpose of science and science learning."
- "The GLOBE projects are better aligned with the scientific methodology and the scope of the works is of higher quality."
- "GLOBE provides a very unique opportunity for K-12 students to summarize their research and discuss it with other STEM community members and peers. Very special!"

Reviewer Satisfaction with the SRS

Overall, the respondents were satisfied with the GLOBE SRS. They were asked to rate their satisfaction with aspects of the experience on a scale of *very dissatisfied* to *very satisfied*. (Figure 14.) Communication with reviewers regarding expectations and on-site support garnered the highest satisfaction ratings. Only one reviewer expressed dissatisfaction with event logistics, the review schedule, and the diversity of STEM Professionals. Respondents were also asked to provide recommendations for improving the GLOBE SRS reviewer experience. Of 11 comments, six centered on requests for more training for reviewers, especially in review criteria and providing feedback to the students. Two remarks focused on the event's logistics, including paid parking and meal options.

All respondents were either *very satisfied* (69%) or *satisfied* (31%) with the GLOBE SRS event as a science learning experience for students. Nine responded to the question asking for recommendations for improvement in the student experience, although two were not recommendations but rather praise for the event, including "I believe it was a very well-planned, event-filled learning experience for all of the attendees." Three reviewers recommended providing the students with time to interact with each other and meet students from different communities or districts.

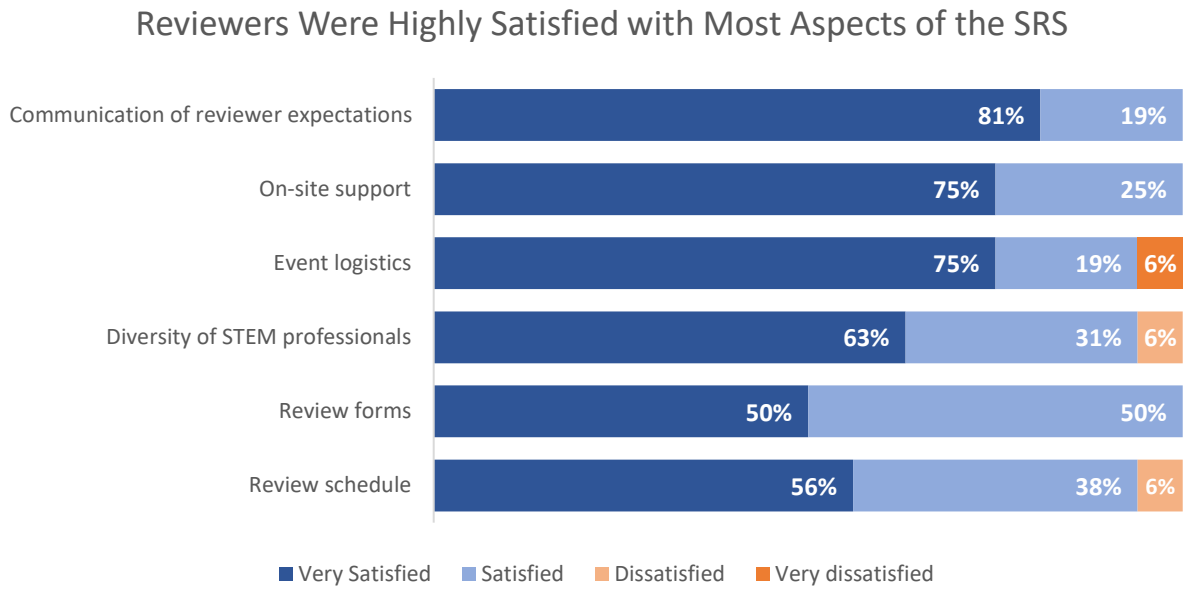


Figure 14. Reviewer satisfaction with aspects of their GLOBE SRS experience (n=16).

Another two reviewers commented about not having enough time to listen to the entire presentation from students or students running out of time to complete their projects before the SRS:

- "Reviewers cannot listen to all the presentations. Could groups be recorded sharing a summary of what their project entails?"
- "I think the GLOBE program can be better at supporting teachers in their implementation of GLOBE projects. Folks always seem to run out of time before getting to the data analysis and interpretation. Questions need to be asked about why they are running out of time?"
- "Perhaps there needs to be different tiers of project reviews at the SRS depending on where they are in the process."

Additional comments included:

- "I'm not sure how reviewer feedback was conveyed to students after they received our forms? Perhaps it might help the students if they heard a general consensus from reviewers on their posters (e.g., what they did well, what they might work on for future posters)?"
- "I think it gets better each year. Maybe a stronger communication with Alaska School districts about this science opportunity."

In final comments, five reviewers offered thanks and praise for the event. One observed that "the GLOBE SRS are transformative—[the SRS] gives a voice to underserved and underrepresented students, gives them the opportunity to know other cultures and travel."

"The GLOBE SRS are transformative—[the SRS] gives a voice to underserved and underrepresented students, gives them the opportunity to know other cultures and travel."
—GLOBE SRS Reviewer

Discussion & Recommendations

The GLOBE 2023 Regional SRS marked a return of the annual events after a four-year pandemic pause. The symposia again offered students an immersive science learning experience including student poster presentations with peer and STEM Professional reviews, opportunities to meet STEM Professionals and other students, hands-on science activities, and field trips and tours. Evaluation results show that the 2023 Regional SRS had a positive impact on participating students and educators, as in 2016 through 2019, and furthermore, they suggest that participation helped to close pandemic gaps in student science engagement. These benefits were accessible not only to those schools and programs with the financial resources to attend but also to the educators and students from high-need schools whose travel, meals, and lodging were covered by GLOBE with the support of NASA and YLACES funding. Participant feedback shows that the non-competitive nature of the GLOBE SRS and the emphasis on growth and collaboration remain their unique and defining features in the student science experience landscape.

According to both educators and students, working on GLOBE research projects for the SRS helped students learn science practices and 21st century skills. Top examples of these include working together as a group, making observations, writing about what was observed and why, reporting on research results, and relating science to issues in their local communities. Additionally, as found in our previous evaluations, participating in the SRS itself had a significant positive influence on students' science self-efficacy and value of science. Students' fears about presenting their research were frequently replaced by a sense of self-confidence and community, and they left describing the SRS in such terms as "fun," "cool," and "welcoming." Most students (over 80%) reported that participating in the SRS impacted their understanding of the scientific process and what it's like to do science research. Some students also experienced a broader change in their worldview and benefited from exposure to different perspectives and ways of doing science at the SRS through their interactions with scientists and with other students.

> **Key finding:** Working on GLOBE research projects for the SRS helped students learn science practices and 21st century skills, and participation in the SRS itself had a positive influence on students' science self-efficacy and value of science. The SRS offered students a unique opportunity to practice their science skills and to see how others are applying them in different ways, broadening their perspective on science and the world around them.
>
> **Recommendation:** The GLOBE SRS model continues to show evidence of positive outcomes for students' science self-efficacy and for value of science. These findings warrant continued support for the Regional SRS and continued efforts to expand access so that more students may benefit from working on GLOBE research projects and presenting their research at the SRS. As a specific event recommendation, include time in the program for students to meet the scientists and also to learn from each other, socialize together, and spark new collaborations. Participant feedback also suggests that more student preparation for peer review would be helpful.

Pandemic-related school disruptions resulted in documented STEM learning loss for K-12 students, disproportionately so for students from low-income households and Black students (Rotermund & Freyman, 2023). Comparison of evaluation data from the 2019 and 2023 GLOBE SRS align with these findings, showing that students' average pre-test ratings on our measures of science self-efficacy and value of science were lower in 2023 than in 2019. However, the average ratings also increased more from before to after the SRS in 2023 than in 2019, suggesting that the SRS experience narrowed the

pandemic gap in science self-efficacy and value of science. Additionally, educators reported that participating in the SRS improved their ability to integrate science learning in their classroom or program—incorporating new ideas, technology, and resources, and engaging learners in research relevant to them. They were also highly satisfied with the SRS overall for themselves and for their students. Many had accessed the consultation and support of their local GLOBE Partnership prior to the SRS. Some felt there could be more communication about GLOBE resources and activities and reported difficulty navigating the GLOBE website.

> **Key finding:** Evaluation results suggest that the return of immersive science activities like the GLOBE SRS may mitigate some of the damage of the pandemic on student engagement in STEM.
>
> **Recommendation:** Promote participation in the SRS to schools and programs as a way to help with STEM learning recovery, citing these positive outcomes. Support GLOBE Partnerships to help them share this message with their regional school districts and programs and help them steer educators to the appropriate GLOBE resources for their learners if needed.

Consistent with previous years, students most enjoyed the SRS field trips and tours, followed by hands-on activities. The majority also enjoyed meeting scientists and meeting other students. They least enjoyed the opening remarks and keynote speakers.

> **Key finding:** We consistently find, perhaps unsurprisingly, that students prefer the active components of the SRS model to the components that involve sitting still and being quiet.
>
> **Recommendation:** While the opening remarks and keynote speakers are important for setting the tone of the events and sharing important information, keep the time spent on these components limited. Reserve most of the SRS agenda time for active learning experiences and interaction among students and scientists.

A total of 201 students and 52 educators participated in the GLOBE 2023 Regional SRS. This is lower participation than before the pandemic in 2019, when 261 students and 66 educators participated. Additionally, the number of GLOBE research projects declined from 114 to 80. The six GLOBE regions were merged into four regional SRS events due to lower than anticipated registration in two of the six regions. These changes suggest there were new or increased barriers to educator and student participation in the SRS, which could be related to curriculum constraints, remaining concerns about travel or large gatherings, or cultural shifts in education. It is widely understood that K-12 teachers were experiencing a number of severe stressors prior to the pandemic that were exacerbated by the pandemic (e.g. McCarthy et al., 2022; Robinson et al., 2023) especially at schools with higher representation of low-income students or students of color (Schmitt & DeCourcy, 2022). On a positive note, almost half of the educators participating in the 2023 Regional SRS were new to the event, indicating that new educators are still joining the GLOBE community despite these stressors. Additionally, participation rebounded to pre-pandemic levels for the five Regional SRS events held in 2024.

> **Key finding:** The 2023 Regional SRS marked a return to the annual events after a four-year pause. Registration was lower than prior to the pandemic in 2019. Yet nearly half of the participating educators were new to the SRS, suggesting that educators are continuing to join

the GLOBE community. By the 2024 SRS, registration had returned to pre-pandemic levels. However, we have not yet analyzed repeat participation of new participants in 2023.

Recommendation: Explore how barriers to participation have changed since the pandemic and new ways to address them to improve educator retention. At the same time, continue recruitment of new educators into the GLOBE community. Track participation to follow trends.

According to educators, the schools participating in the GLOBE 2023 Regional SRS include representation of rural (44%) and urban (31%) as well as suburban (21%) and other communities. School enrollment data show at least half of participating students represented schools where the majority of students are economically disadvantaged, and where the majority of students identify as a race or ethnicity that is an underrepresented minority in STEM (URM students; Black or African American, Hispanic or Latino/a/x, or Native American or Alaskan Native). Data from parent/guardian completed student registrations show that at least 31% of participating students themselves were from households with annual incomes under $50,000—among them at least 15% from households with annual incomes below the federal poverty line—and 35% identified as a race or ethnicity underrepresented in STEM; 60% identified their gender as female. In approximately a quarter of participating student households, the highest level of education completed by an adult was a high school diploma or GED or less than a high school diploma. URM students had significantly lower average agreement with multiple science self-efficacy statements at both pre-test and post-test than non-URM students but experienced the same positive changes from before to after the SRS. This suggests that experiences like the SRS are valuable for increasing science engagement among students identifying as a race or ethnicity underrepresented in STEM.

Key finding: NASA and YLACES sponsorship has supported not only the SRS events themselves but also investments in GLOBE U.S. Partner outreach to schools in minoritized communities and funding to cover SRS travel expenses. The results of these investments were evident in the participation of students from low-income communities and households, and the participation of students identifying as a race or ethnicity underrepresented in STEM.

Recommendation: NASA and YLACES support remains critical to the objectives of reducing barriers, expanding access, and broadening participation in the GLOBE SRS and in STEM.

STEM Professional Reviewers play a critical role in the SRS. Students described how interacting with STEM Professionals changes their perspective on scientists, scientific research, and science itself. The diversity of STEM Professionals at the SRS is also important for students' sense of representation and belonging in science. Research shows that students' engagement with STEM benefits from seeing scientists who look like them and the people in their communities (e.g. Barakat, 2022; Martin & Fisher-Ari, 2021). Reviewers were generally satisfied with their experience at the GLOBE SRS, particularly communication of reviewer expectations and on-site support. They appreciated that the SRS is not competitive like a science fair but rather emphasizes learning and collaboration. However, they still see opportunities for more training in the review criteria and providing feedback to students. The response rate for the reviewer survey was fairly low, making it difficult to assess the diversity of reviewer representation and the generalizability of results to all the reviewers.

Key finding: STEM Professional reviewers are important to the student experience of the SRS, and the diversity of STEM Professional SRS reviewers is important for student representation and belonging in science. Reviewers found the SRS experience unique and different from typical

science fairs; they appreciated how the less competitive environment of the SRS encourages authentic learning and collaboration. They are generally satisfied with preparation and support for their role but still see some room for improvement.

Recommendation: The recruitment and retention of a diverse pool of STEM Professional reviewers is important to the ongoing success of the SRS. Improve the advance preparation of reviewers so they feel equipped to execute their role successfully. The better their experience, the more likely they are to participate in future events and to bring in colleagues to serve as reviewers by word of mouth. We have already made changes to how we are collecting data with reviewers in 2024 to better inform recommendations in this area going forward.

In general, the SRS showed evidence of a positive impact on students' science identity and belonging. However, a different picture emerged looking specifically at the outcomes for students who identify as a race or ethnicity that is an underrepresented minority in STEM (URM students). URM students reported a greater *increase* from pre-test to post-test than non-URM students on an item related to science identity and representation, indicating that participation in the SRS helped URM students to see that scientists are like the people in their own communities. However, URM students' sense of belonging at the SRS showed a slight pre-test to post-test *decrease* while there was an increase for non-URM students and a significant increase for students overall.

Key finding: Participation in the SRS helped students who identify as a race or ethnicity underrepresented in STEM to see that scientists can be like the people in their own communities, suggesting that GLOBE's efforts toward representation at the SRS is yielding benefits for students. However, intentionally fostering the sense of belonging and inclusion among students underrepresented in STEM at the GLOBE SRS is an area for improvement to build on successes in reducing barriers, expanding access, and broadening participation.

Recommendation: Although we are unable to report on URM students' experience of belonging at the SRS in greater detail for participant privacy reasons, we are exploring the issue internally and will provide recommendations for future events based on what we learn.

Overall, the evaluation results provide ample evidence that the GLOBE U.S. 2023 Regional SRS were successful in achieving their objectives of increasing students' interest and engagement in science, broadening participation in science learning activities, and building a supportive scientific community of students, educators, and STEM Professionals. Areas for improvement include assistance for educators in accessing GLOBE resources, support for reviewer preparation, and most importantly, fostering a sense of belonging at the SRS for URM students. After recovering from the pandemic pause participation may increase with or without specific intervention, but in either case, continued efforts to reduce barriers to participation will allow more students and educators to access the demonstrated benefits of the SRS.

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Appendix A: Methods

Survey Instruments & Administration

The SRS registration survey was conducted online via Qualtrics in the months before the SRS. Educators completed their own registrations, and parents and guardians submitted registrations for students. The registration survey included contact information, school information, participant demographics, and student household demographics, as well as information for event planning not used for evaluation (e.g., dietary restrictions). For educators, the registration survey also included items regarding their background in education, learner population, GLOBE research projects, and previous SRS participation.

Student and educator questionnaires were originally developed by GLOBE staff for the 2016 SRS under a National Science Foundation grant (NSF Grant No. 1546713). Significant changes to the student survey were made in 2017 to focus more on science self-efficacy. In 2023 the educator survey was substantially reduced in length by removing scales previously included for the original NSF study. We added new items addressing students' sense of science representation and belonging, and asked students and educators about learning science practices and 21st century skills through working on GLOBE projects by adapting items from the original educator survey. References for the supporting literature used in educator and student survey development can be found in Appendix C, and the survey questionnaires can be viewed in Appendices D, E, and F.

The student pre-test and post-test and the educator post-only surveys were conducted by paper and pencil on site at the SRS. Staff from the GLOBE U.S. Coordination Office administered the surveys in cooperation with event leads. Students and educators entered their event badge numbers on the survey questionnaires. We used the badge numbers to link the survey data with registration data, and for students, to match cases across pre-test and post-test survey data. The reviewer post-only survey was conducted online via Qualtrics after the four SRS events concluded.

Survey Samples

Student Survey Sample

Two hundred one students attended the 2023 SRS. Parents/guardians completed the registration survey for 197 students. One hundred eighty-nine completed the pre-test survey (91%), 178 completed the post-test survey (89%), and we were able to match pre-post survey data for 165 students (82%). Twelve Midwest SRS student post-survey questionnaires were missing badge numbers and so could not be linked to registration data or matched to pre-test survey data—which explains why the Midwest post-survey response rate is 100% but the matched pre-post response rate is only 74%. (Tables 10 & 11.)

Table 10. Student survey response rates by region.

Region	Attended	Registered	Pre-survey		Post-survey		Matched Pre-post	
			#	Resp. Rate	#	Resp. Rate	#	Resp. Rate
Midwest	46	46	45	98%	46	100%	34	74%
Northwest	65	65	63	97%	61	94%	61	94%
Pacific	37	37	33	89%	32	86%	32	86%
Southwest	53	49	48	91%	39	74%	38	72%
TOTAL	**201**	**197**	**189**	**94%**	**178**	**89%**	**165**	**82%**

Table 11. Demographics of all students registered for the SRS and for the matched pre-post sample.

	Registered (n=197)		Matched Pre-Post (n=165)	
	n	%	*n*	%
Region				
Midwest	46	23.4%	34	20.6%
Northwest	65	33.0%	61	37.0%
Pacific	37	18.8%	32	19.4%
Southwest	49	24.9%	38	23.0%
Grade band				
4 to 5	19	9.6%	17	10.3%
6 to 8	55	27.9%	51	30.9%
9 to 12	123	62.4%	95	57.6%
Missing	0	0.0%	2	1.2%
Gender (non-exclusive)				
Female	118	59.9%	107	65.6%
Male	76	38.6%	40	33.7%
Non-binary	--	--	--	--
Other	--	--	--	--
Prefer not to answer	--	--	--	--
Missing	--	--	--	--
Race/ethnicity (non-exclusive)				
Asian	19	8.4%	16	8.6%
Black or African American	11	4.8%	--	--
Hispanic, Latino/a/x, or Spanish origin	43	18.9%	40	21.4%
Middle Eastern or North African	17	7.5%	10	5.3%
Native American or Alaskan Native	25	11.0%	24	12.8%
Native Hawaiian or other Pacific Islander	0	0.0%	0	0.0%
White	103	45.4%	82	43.9%
Other race, ethnicity, or origin	3	1.6%	--	--
Prefer not to answer	6	3.2%	--	--
Missing	--	--	--	--
Annual household income				
$0 - $24,999	30	15.2%	27	16.4%
$25,000 - $49,999	32	16.2%	29	17.6%
$50,000 - $74,999	15	7.6%	14	8.5%
$75,000 - $99,999	18	9.1%	14	8.5%
$100,000 - $124,999	18	9.1%	17	10.3%
$125,000 - $149,000	12	6.1%	11	6.7%
$150,000 and higher	18	9.1%	16	9.6%
Prefer not to answer	54	27.4%	35	21.2%
Missing	0	0.0%	2	1.2%
Household educational attainment				
Less than high school diploma	19	9.6%	16	9.7%
High school diploma or GED	32	16.2%	26	15.8%
Some college, but no degree	26	13.2%	25	15.2%
Associate degree	16	8.1%	15	9.1%
Bachelor's degree	36	18.3%	32	19.4%
Master's degree	35	17.8%	26	15.8%
Professional degree beyond bachelor's	--	--	--	--
Doctorate degree	--	--	--	--
Prefer not to answer	23	11.7%	18	10.9%
Missing	--	--	--	--

Educator Survey Sample

Fifty-two educators attended the SRS. Of these, 49 completed the online registration survey. Educators were administered the paper and pencil post-survey on site at the close of each SRS. (There was no educator pre-survey.) In total 42 educators (81%) completed the post-survey. (Tables 12 & 13.)

Table 12. Educator survey response rates by region.

Region	Attended	Registered	Post-survey	Resp. Rate
Midwest	12	12	8	67%
Northwest	21	21	19	90%
Pacific	11	11	9	82%
Southwest	8	5	6	75%
TOTAL	**52**	**49**	**42**	**81%**

	Registration (n=49)		Post-Only Survey (n=42)	
	n	%	*n*	%
Region				
Midwest	12	23.1%	8	19.0%
Northwest	21	40.4%	19	45.2%
Pacific	11	21.2%	9	21.4%
Southwest	8	15.3%	6	14.3%
Gender (non-exclusive)				
Female	34	69.4%	30	71.4%
Male	16	24.2%	11	26.2%
Non-binary	--	--	--	--
Other	--	--	--	--
Prefer not to answer	--	--	--	--
Missing	--	--	--	--
Race/ethnicity (non-exclusive)				
Asian	--	--	--	--
Black or African American	--	--	--	--
Hispanic, Latino/a/x, or Spanish origin	--	--	--	--
Middle Eastern or North African	0	0.0%	0	0.0%
Native American or Alaskan Native	--	--	--	--
Native Hawaiian or other Pacific Islander	0	0.0%	0	0.0%
White	40	75.5%	34	73.9%
Other race, ethnicity, or origin	0	0.0%	0	0%
Prefer not to answer	3	5.7%	2	4.3%
Missing	--	--	--	--

Reviewer Survey Sample

Unlike the student and educator surveys, the reviewer post-survey was conducted online via Qualtrics after the SRS concluded. Forty-four reviewers attended the 2023 SRS and 16 completed the survey for a response rate of 36%. (Table 13.) Therefore, results may not be generalizable to all reviewers, and we are unable to report on reviewer demographics to protect participant privacy.

Table 13. Reviewer survey response rates by region.

Region	Attended	Post-survey	Resp. Rate
Midwest	10	4	40%
Northwest	17	7	41%
Pacific	9	4	44%
Southwest	8	1	13%
TOTAL	**44**	**16**	**36%**

School Enrollment Data

Educators submitted their school information (e.g., name and location of school) in the registration survey, and parents/guardians provided school information for student registrations. This allowed us to search publicly available enrollment data for their schools on the states' education department website. We used the enrollment data to describe student and educator school communities in order to better understand SRS reach and participation. School data were unavailable or incomplete for 10 students and 6 educators participating in homeschooling or alternative education settings. Additionally, private school data for fewer than 5 students and educators included in the analysis of participating schools are from 2019-20, the most recent available year of data via the National Center for Education Statistics' Private School Universe Survey Data. The remainder of the data are from the 2022-23 academic year.

Data Preparation and Analysis

Educator and student paper survey questionnaires were entered into electronic data files for analysis and merged with registration data by ID. Quantitative data were analyzed descriptively. Student survey data were also analyzed longitudinally to measure change from pre-test to post-test (paired samples t-tests) and comparatively for group differences (independent samples t-tests), and multivariate tests identified differences in change over time between groups (mixed between-within ANOVAs). Quantitative data were analyzed using SPSS and visualized in Excel. Test tables for the significant findings in the report can be viewed in Appendix B. Responses to open-ended survey questions were coded by theme in Excel for the educator and reviewer survey data and coded by theme and sentiment in NVivo for the student survey data due to the larger volume of responses.

Please contact eleanor.jaffee@insightsevaluation.com if you have questions or comments about the evaluation methods, instruments, or reporting.

Appendix B: Test Tables

This appendix displays statistical test results for significant findings reported in the Student SRS Outcomes section of the report. Quantitative analyses were conducted with SPSS.

Table 14. Paired samples t-test: All students' average agreement with science self-efficacy, value, identity, and belonging items on a scale of 1 strongly disagree *to 6* strongly agree*.*

Paired Samples t-test: All students pre-test to post-test								
	M(pre)	*M*(post)	*M*	*SD*	*t*	*df*	*p*	*d*
I am able to learn new things in science.	5.36	5.47	-.109	0.635	-2.208*	164	.014	.172
I am able to ask good questions to do science research.	4.62	4.93	-.305	0.875	-4.463***	163	<.001	.348
I am able to analyze data to do science research.	4.83	5.01	-.184	0.848	-2.771**	162	.003	.217
I am able to interpret data in science research.	4.75	5.02	-.270	0.891	-3.828***	158	<.001	.304
I am able to construct scientific arguments.	4.55	4.87	-.319	0.967	-4.213***	162	<.001	.330
I am able to present my research to others.	4.85	5.28	-.426	1.062	-5.104***	161	<.001	.401
I am able to conduct peer review of other students' science research.	4.60	5.00	-.396	1.111	-4.568***	163	<.001	.357
I am good at science.	4.82	4.95	-.121	0.839	-1.855*	164	.033	.144
Being good at science is important.	5.24	5.33	-.093	0.703	-1.676*	161	.048	.132
I want to have a career in science someday.	4.25	4.40	-.148	0.893	-2.111*	161	.018	.166
I am proud of my accomplishments in science.	5.16	5.14	.019	0.810	0.292	160	.385	-.023
Some scientists are like the people in my community.	4.53	4.82	-.292	0.959	-3.861***	160	<.001	.304
People like me can be scientists.	5.34	5.33	.006	0.749	0.105	162	0.458	-.008
I enjoy meeting people who are different from me.	5.46	5.37	.091	0.909	1.284	164	0.100	-.100
People like me belong at the GLOBE SRS.	4.98	5.14	-.165	0.824	-2.560**	163	0.006	.200
I am a member of GLOBE.	5.03	5.32	-.290	1.001	-3.688***	161	<.001	.290

Table 15. Independent samples t-tests: Average agreement of students identifying as a race/ethnicity underrepresented in STEM (URM) compared with non-URM students at pre-test and post-test on a scale of 1 strongly disagree *to 6* strongly agree*.*

Independent Samples t-test: Non-URM and URM students at pre-test and post-test							
	Non-URM (n=96)		URM (n=67)				
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
Pre-test							
I am able to learn new things in science.	5.48	0.680	5.21	0.749	2.393**	161	.009
I am able to ask good questions to do science research.	4.86	0.918	4.30	1.101	3.548***	160	<.001
I am able to analyze data to do science research.	5.06	0.868	4.52	1.146	3.259***	116	<.001
I am able to interpret data in science research.	5.02	0.816	4.35	1.130	4.138***	111	<.001
I am able to construct scientific arguments.	4.77	1.010	4.21	1.222	3.173***	160	<.001
I am good at science.	5.00	1.005	4.58	1.195	2.415**	161	.008
Some scientists are like the people in my community.	4.67	1.239	4.32	1.069	1.870*	158	.032
People like me belong at the SRS.	4.96	1.085	4.99	1.066	-.0.156	161	.438
Post-test							
I am able to learn new things in science.	5.59	0.573	5.30	0.871	2.433**	105	.008
I am able to ask good questions to do science research.	5.16	0.838	4.57	1.158	3.565**	113	.003
I am able to analyze data to do science research.	5.20	0.811	4.75	1.133	3.529***	158	<.001
I am able to interpret data in science research.	5.23	0.818	4.71	1.057	3.529***	158	<.001
I am able to construct scientific arguments.	5.01	0.888	4.65	1.102	2.288*	160	.012
I am good at science.	5.14	0.958	4.66	1.023	3.052**	161	.001
Some scientists are like the people in my community.	4.89	1.178	4.74	1.057	0.791	160	.215
People like me belong at the SRS.	5.27	0.916	4.96	1.121	1.985*	160	.024

Table 16. Mixed between-within ANOVA: Average agreement on belonging at the SRS by non-URM or URM student pre-test to post-test on a scale of 1 strongly disagree *to 6* strongly agree.

Mixed Between-Within ANOVA: Non-URM and URM students pre-test to post-test							
	Non-URM (n=95)		URM (n=67)				
	M	*SD*	*M*	*SD*	*F*	*df*	*p*
Pre-test: People like me belong at the GLOBE SRS.	4.96	1.091	4.99	1.066	--	--	--
Post-test: People like me belong at the GLOBE SRS.	5.27	0.916	4.96	1.121	7.475**	160	.007

Table 17. Independent samples t-tests: Average agreement of middle school and high school grade band students at pre-test and post-test on a scale of 1 strongly disagree *to 6* strongly agree.

Independent Samples t-test: Middle school and high school students at pre-test and post-test							
	Middle School (n=68)		High School (n=95)				
	M	*SD*	*M*	*SD*	*t*	*df*	*p*
Pre-test							
I am able to analyze data to do science research.	4.74	1.128	4.92	0.942	1.078	128	.142
I am able to conduct peer review of other students' science research.	4.38	1.222	4.75	0.978	-2.039*	124	.022
Being good at science is important.	5.35	0.794	5.16	0.982	1.307	159	.097
I want to have a career in science someday.	3.87	1.475	4.47	1.420	-2.614**	160	.005
Post-test							
I am able to analyze data to do science research.	4.76	1.081	5.19	0.863	-2.798**	159	.003
I am able to conduct peer review of other students' science research.	4.85	1.158	5.09	0.864	-1.462	115	.073
Being good at science is important.	5.51	0.746	5.20	0.858	2.368*	160	.010
I want to have a career in science someday.	3.94	1.506	4.68	1.346	-3.274***	159	<.001

Appendix C: Supporting Literature

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Appendix D: Student Pre-Survey

GLOBE 2023 SRS Student Pre-Survey

This survey will help us understand how GLOBE is 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, you may ask an event leader to help you.

PLEASE ENTER YOUR BADGE NUMBER (NOT YOUR NAME) HERE: _____

1. Please circle the response below that most closely matches your beliefs about science.

Key: 1 = Strongly disagree, 2 = Disagree, 3 = Disagree a little, 4 = Agree a little, 5 = Agree, 6 = Strongly agree	**Circle one response for each.** 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 analyze data 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 construct scientific arguments.	1	2	3	4	5	6
I am able to present my research to others.	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
Being good at science is important.	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
Some scientists are like the people in my community.	1	2	3	4	5	6
People like me can be scientists.	1	2	3	4	5	6
I enjoy meeting people who are different from me.	1	2	3	4	5	6
People like me belong at the GLOBE SRS.	1	2	3	4	5	6
I am a member of GLOBE.	1	2	3	4	5	6

2. **How much did working on a GLOBE project for the SRS help you learn to do each of the following things?**

	Circle one response for each.			
Make observations and record data	None	A little	Some	A lot
Organize data into charts or graphs	None	A little	Some	A lot
Write about what was observed and why it happened	None	A little	Some	A lot
Identify references, citations, and acknowledgements of others in your research	None	A little	Some	A lot
Consider alternative explanations	None	A little	Some	A lot
Change your research plan if needed	None	A little	Some	A lot
Work together as a group (for example, communicate with each other, resolve differences, be reliable, be supportive)	None	A little	Some	A lot
Relate science to issues in your local environment or local community	None	A little	Some	A lot
Present research results in a poster	None	A little	Some	A lot

THANK YOU FOR PARTICIPATING!

Please return this survey to an event leader.

Appendix E: Student Post-Survey

GLOBE 2023 SRS Student Post-Survey

This survey will help us understand how GLOBE is 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, you may ask an event leader to help you.

PLEASE ENTER YOUR BADGE NUMBER (NOT YOUR NAME) HERE:

1. Please circle the response below that most closely matches your beliefs about science.

Key: 1 = Strongly disagree, 2 = Disagree, 3 = Disagree a little, 4 = Agree a little, 5 = Agree, 6 = Strongly agree	Circle one response for each. 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 analyze data 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 construct scientific arguments.	1	2	3	4	5	6
I am able to present my research to others.	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
Being good at science is important.	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
Some scientists are like the people in my community.	1	2	3	4	5	6
People like me can be scientists.	1	2	3	4	5	6
I enjoy meeting people who are different from me.	1	2	3	4	5	6
People like me belong at the GLOBE SRS.	1	2	3	4	5	6
I am a member of GLOBE.	1	2	3	4	5	6

2. **Did participating in the SRS impact your understanding of the scientific process and what it's like to do science research?**

◯ Yes ◯ No ◯ Don't know/Not sure

Please explain your answer.

_____

_____

_____

_____

3. **What part of the SRS did you enjoy the MOST? Choose as many as you want.**

☐ Opening remarks	☐ Meeting scientists
☐ Keynote speaker	☐ Meeting other students
☐ Research presentations to the reviewers	☐ Hands-on science activities
☐ Research presentations to other students	☐ Field trip or tour
☐ Review from scientists	☐ Other: _____
☐ Review from other students	☐ Other: _____

4. **Please describe what you enjoyed MOST about the SRS and why.**

_____

_____

_____

_____

5. **What part of the SRS did you enjoy the LEAST? Choose as many as you want.**

☐ Opening remarks	☐ Meeting scientists
☐ Keynote speaker	☐ Meeting other students
☐ Research presentations to the reviewers	☐ Hands-on science activities
☐ Research presentations to other students	☐ Field trip or tour
☐ Review from scientists	☐ Other: _____
☐ Review from other students	☐ Other: _____

6. **Please describe what you enjoyed LEAST about the SRS and why.**

_____

_____

_____

_____

7. **Before the SRS I thought:**

_____

_____

_____

But now I know:

_____

_____

_____

THANK YOU FOR PARTICIPATING!

Please return this survey to an event leader.

Appendix F: Educator Post-Survey

GLOBE 2023 SRS Educator Survey

This survey will help us understand how GLOBE is helping educators facilitate science learning and gather feedback about the SRS to inform future GLOBE event planning. You may skip any questions you do not want to answer or cannot answer. If you have a question, please ask an event leader to help you.

PLEASE ENTER YOUR BADGE NUMBER (NOT YOUR NAME) HERE: ☐

1. Please check (✓) the boxes for the GLOBE resources: **a.** you used prior to the SRS, **b.** your learners used prior to the SRS, and **c.** you plan to use in the future.

GLOBE Resources	a. I used prior to the SRS	b. Learners used prior to the SRS	c. I plan to use in the future
Consultation/support from your local GLOBE partnership	☐	☐	☐
GLOBE Watercoolers	☐	☐	☐
Educator blog posts	☐	☐	☐
Science practices resource pages (located on internal GLOBE SRS webpages)	☐	☐	☐
Mentorship with a STEM professional from the GLOBE International STEM network	☐	☐	☐
Emails from the United States GLOBE Office	☐	☐	☐
Other: ☐	☐	☐	☐

2. How can we improve the content, quality, or accessibility of GLOBE educator resources?

_____

_____

_____

_____

3. Did participating in the SRS improve your ability to integrate science research in your classroom or program? (Please select one.)

◯ Yes ◯ No

If YES, how?

_____

_____

_____

_____

PLEASE ENTER YOUR BADGE NUMBER (NOT YOUR NAME) HERE:

4. To what extent do you AGREE that doing a GLOBE project with the students in your class or program this year helped you to facilitate their skill development in each of the following areas?

Key:
1 = Strongly disagree
2 = Disagree
3 = Disagree a little
4 = Agree a little
5 = Agree
6 = Strongly agree
NA = Not applicable

Please circle one response for each area.

	Strongly DISAGREE ←					→ Strongly AGREE	
Generating questions or predictions to explore	1	2	3	4	5	6	NA
Choosing variables to investigate	1	2	3	4	5	6	NA
Designing or implementing their own investigations	1	2	3	4	5	6	NA
Making observations and recording data	1	2	3	4	5	6	NA
Organizing data into charts or graphs	1	2	3	4	5	6	NA
Analyzing relationships using charts or graphs	1	2	3	4	5	6	NA
Explaining the reasoning behind an idea	1	2	3	4	5	6	NA
Supplying evidence to support a claim or explanation	1	2	3	4	5	6	NA
Communicating the outcome of their research investigations	1	2	3	4	5	6	NA
Identifying references, citations, and acknowledgements of others in their research	1	2	3	4	5	6	NA
Considering alternative explanations	1	2	3	4	5	6	NA
Adjusting to changes in the course of a project as needed	1	2	3	4	5	6	NA
Connecting a project to issues in their local environment or community	1	2	3	4	5	6	NA
Collaborating on a group project (e.g., communicating, resolving differences, being reliable, supporting others)	1	2	3	4	5	6	NA

5. What was the most significant outcome for your class or program of doing a GLOBE project?

PLEASE ENTER YOUR BADGE NUMBER (NOT YOUR NAME) HERE: _____

6. How satisfied were you with each of the following aspects of the SRS experience?

Key:
1 = Very dissatisfied
2 = Dissatisfied
3 = Slightly dissatisfied
4 = Slightly satisfied
5 = Satisfied
6 = Very satisfied
NA = Not applicable

Please circle one response for each aspect.

	Very DISSATISFIED ← → Very SATISFIED						
The SRS overall for myself	1	2	3	4	5	6	NA
The SRS overall for my learners	1	2	3	4	5	6	NA
Opening remarks	1	2	3	4	5	6	NA
Keynote speaker	1	2	3	4	5	6	NA
Student research presentations to the reviewers	1	2	3	4	5	6	NA
Student research presentations to other students	1	2	3	4	5	6	NA
Review from scientists	1	2	3	4	5	6	NA
Peer review from other students	1	2	3	4	5	6	NA
Hands-on science activities	1	2	3	4	5	6	NA
Field trips or tours	1	2	3	4	5	6	NA
Opportunities to meet other educators	1	2	3	4	5	6	NA
Opportunities to meet scientists	1	2	3	4	5	6	NA
Representation of scientists who look like people from my learners' home community	1	2	3	4	5	6	NA
Cultural relevance for my learners	1	2	3	4	5	6	NA
Event venue	1	2	3	4	5	6	NA
Event location	1	2	3	4	5	6	NA
Event schedule	1	2	3	4	5	6	NA
Other (write in): _____	1	2	3	4	5	6	NA

PLEASE ENTER YOUR BADGE NUMBER (NOT YOUR NAME) HERE:

7. Please explain your level of satisfaction with the SRS for yourself and/or your learners.

8. How can we improve the SRS objectives, scheduling, or setting?

If you DID NOT participate in professional development (PD) at the SRS, you have completed the survey. Please return it to an event team member. Thank you!

If you DID participate in PD, please complete the items below before returning your survey to an event team member. Thank you!

9. To what extent do you AGREE with each statement about the PD experience?

Key:
1 = Strongly disagree
2 = Disagree
3 = Disagree a little
4 = Agree a little
5 = Agree
6 = Strongly agree
NA = Not applicable

Please circle one response for each statement.

	Strongly DISAGREE ← → Strongly AGREE						
The materials were helpful.	1	2	3	4	5	6	NA
The trainers were knowledgeable.	1	2	3	4	5	6	NA
The training structure provided ample time for hands-on experiences.	1	2	3	4	5	6	NA
Overall, this GLOBE training was valuable and worthwhile.	1	2	3	4	5	6	NA

10. How can we improve the PD experience?