Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

Workshop Report

Virtual presentations and discussions held April 13–15, 2021

Cover: REU students hike a recently formed moraine that was deposited by the glacier. Kongsfjorden, Ny Alesund, Svalbard, Norway. *Photo by Peggy McNeal (PolarTREC 2014), courtesy of ARCUS.*

Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

Workshop Report

Virtual presentations and discussions held April 13–15, 2021

This workshop was hosted by the Arctic Research Consortium of the United States and funded by the National Science Foundation under Cooperative Agreement No. PLR-1304316 and PLR-1928794.

ARCUS
Arctic Research Consortium of the United States

International Arctic Research Center

NSF

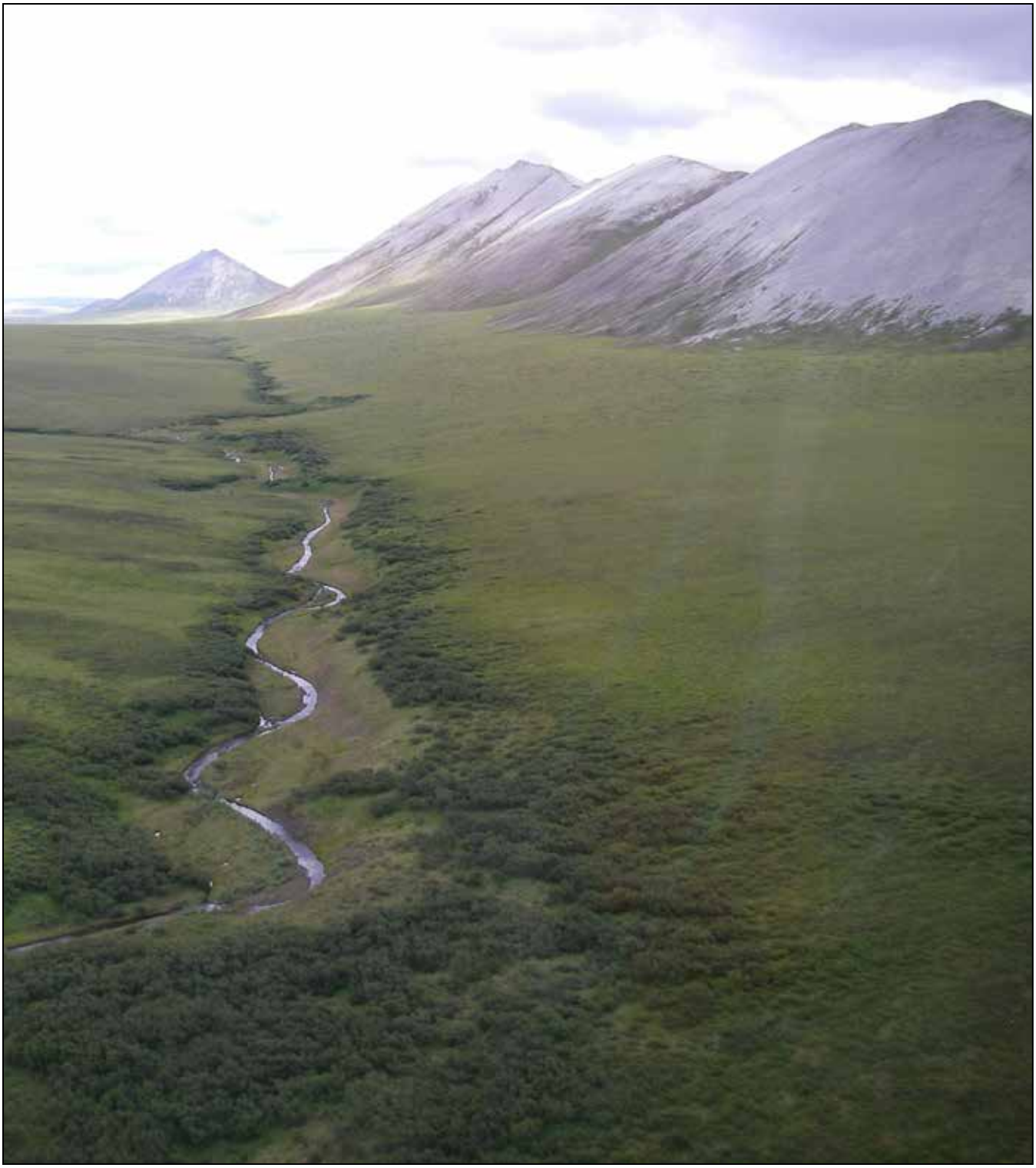


Photo by Karl Horeis (PolarTREC 2010), courtesy of ARCUS.

Table of Contents

Acknowledgments and Partners

The Arctic Research Consortium of the U.S. (ARCUS) would like to give special thanks to the Interagency Arctic Research Policy Committee (IARPC) Arctic STEM Education Working Group for initiating this work, and the International Arctic Research Center (IARC) at the University of Alaska Fairbanks for collaborating and partnering on this project.

Thank you to Alli Harvey of Information Insights, Inc., of Fairbanks, Alaska, for her hard work facilitating this project.

The following individuals served on the steering committee, and we couldn't have done the workshop with their support and inspiration. Thank you to Michael Castellini, Linda Nicholas-Figueroa, Beth Spangler, Sorina Stalla, Amy Topkok, Vladimir Alexeev, and especially students Kimberly Pikok, Michelle Quillin, and Margaret Rudolf. Malinda Chase and Sean Topkok were collaborators on the initial proposal. Additional support and guidance came from Kaja Brix and Lisa Rom (co-chairs, IARPC Arctic STEM Education Working Group) and Janet Warburton and Helen Wiggins (ARCUS). Support during the workshop was provided by Kuba Grzeda, Judy Fahnestock, Olivia Lee, Sarah Crowley, Diane Hirshberg, Bryan Cespedes, and Kasey Casort. Special thank you to Elder Elizabeth Fleagle for her blessing and words of encouragement. Thanks to Putt Clark for her amazing agenda template.

Finally, ARCUS would like to recognize Maureen Biermann, program coordinator for the Center for Arctic Policy Studies at the International Arctic Research Center, University of Alaska Fairbanks, for preparing this final workshop report; and Sorina Stalla, formerly with the International Arctic Research Center, University of Alaska Fairbanks, for preparing the Listen and Learn Sessions report. This report's graphic design, layout, and copy-editing was completed by Sue Mitchell, Inkworks.

Suggested Citation

Arctic Research Consortium of the United States. 2021. *Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM: Workshop Report.* ARCUS, Fairbanks, Alaska.

Executive Summary

The Arctic is undergoing rapid and significant changes. These changes require communities to be aware, informed, and involved to be able to address complex environmental, economic, and social challenges with their associated Arctic science, technology, engineering, and mathematics (STEM) needs. These challenges require a diverse workforce with different backgrounds, perspectives, and knowledge to develop responses to new and emerging issues. In particular, there is a greater need for better representation of rural and Alaska Native undergraduate students in STEM programs to ensure a more diverse Arctic STEM workforce.

To address this issue, the virtual workshop Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM was held from April 13–15, 2021. The goal of the workshop was to bring together rural and Alaska Native undergraduates and youth, federal agency representatives, researchers on Arctic STEM projects, Indigenous faculty and staff, those from the private sector, and rural Alaska community members to discuss the gaps, challenges, opportunities, and successful practices to increase and support the representation of rural and Alaska Native undergraduates and youth in STEM education and career pathways. For this workshop, *youth* is defined as the age group or grade level of upper high school (sophomore to senior, approximately age 15 to 18).

The workshop was an initiative of the IARPC Arctic STEM Education Working Group and was hosted by the Arctic Research Consortium of the U.S. (ARCUS) with funding from the National Science Foundation (NSF PLR 1304316 and PLR 1928794). The International Arctic Research Center at the University of Alaska Fairbanks (IARC) was subcontracted to provide support for the planning and execution of the workshop (see Appendix 1 for a list of acronyms). A series of Listen and Learn Sessions (Appendix 2) were held before the workshop to set foundational themes and draft recommendations to be discussed and refined during the workshop.

Seventy-three participants attended the three-day workshop, which included a series of plenary sessions and smaller breakout sessions addressing two guiding questions:

1. What can be done to increase rural and Alaska Native undergraduate and youth participation in existing Arctic STEM programs?
2. What can programs do differently or how can programs adapt to support student engagement?

By the end of the workshop, a nonprioritized list of recommendations was created to respond to these questions. This list was generated from key points identified by breakout groups on day three of the workshop. Each breakout group shared their main takeaways with the larger group, and a large group discussion followed to expand and refine main ideas.

For the preparation of this report, these recommendations have been synthesized and sorted into seven thematic areas. Below, the full list of recommendations follows each numbered theme. Supporting quotations from notes taken during the workshop are included with the list of recommendations in section 4 (p. 20) of the report to clarify and round out the recommendations.

Theme One: Increase early outreach and exposure to STEM

- Create more preparatory programs that address regional needs and diverse approaches.
- Engage more with high-school freshmen and younger students; existing programs mostly target sophomores and juniors.
- Increase personal engagement and communication. Pay more attention to how we are actually reaching and communicating with students.
- Integrate research into courses in the K–12 system; incorporate citizen science. Make courses relevant to place and culture.
- Time outreach activities appropriately throughout the year, being sensitive to subsistence and/or yearly events already occurring in communities.

Theme Two: Define STEM broadly and inclusively to capture a wider group of students

- Use a broader definition of science and STEM. Be more holistic and have social sciences and humanities integrated. Do not just focus on STEM fields on their own.
- Avoid gatekeeping in science. Make sure an inclusive definition of science is used so that social science and Indigenous knowledge are not excluded. *(Gatekeeping is defined as limiting access.)*
- Encourage finding ways to integrate STEM identities and Indigenous identities.
- Help—and create programs for—students who do not have a high grade-point average. They need an entry point.
- Encourage students in a variety of programs besides just in STEM. Include the social sciences so that some blending can occur for those with similar interests.
- Consider the needs of nontraditional students.

Theme Three: Redefine how program objectives and success are measured to ensure they are relevant to students and communities

- Make sure scientists, researchers, and STEM program leaders ask themselves: What is the purpose of what we are doing? What are the intended and actual outcomes? What do we see students doing, and where do we see them going, after? What are their opportunities and desires, and needs in communities, and how can we align them better?
- Skills needed to conduct scientific work are varied; make sure that the skills students gain are applicable to other aspects of their lives.
- Shift away from individualistic thinking and more toward communal/community-based thinking.

Theme Four: Draw on partnerships with multiple sectors and organizations

- Create more partnerships with industries.
- Work more with existing programs (RAHI, ANSEP, Upward Bound; see Appendix 1 for acronyms and Appendix 3 for more information about individual programs). Continuity in and across programs is important.
- Create a website repository of available programs across Alaska (not just University of Alaska) for educators and students, so that programs are easier to access.
- Encourage better collaboration among STEM programs and organizing entities (e.g., partner with programs or organizations that work with Indigenous youth) from many institutions and not just one institution.
- Work with local Alaska Natives and Native organizations (nonprofit and for-profit) to get better input early on in designing and/or maintaining available programs or grants.
- Help agencies and organizations that work in Alaska but are not based here get an Alaska perspective.

Theme Five: Shift power to students and communities

- Move power to the communities by engaging and involving them early in program design, program recruitment, and making funding decisions.
- Make sure the right people are at the table. If needed, slow down the process to make sure the right people are there. Plan carefully to include extra time that may be needed. This might require challenging federal agencies to institute change in this area.
- Change the starting point of projects so that students, along with communities, drive what projects look like.

Theme Six: Remove hurdles to participation, including structural and systemic hurdles

- Include more thought about and discussion around systemic issues.
- Provide more internet access and bandwidth in communities.
- Incentivize programs so that students want to and are able to participate. Provide livable wages.

Theme Seven: Respect and include Indigenous knowledge and ways of being

- Make relevancy a primary goal and make sure diverse worldviews are considered.
- Be aware of and work flexibly around seasonal subsistence activities and timing, so that students have the capacity to participate in these activities.

A draft of this workshop report was submitted to the steering committee, workshop participants, and broader community members for review and to solicit any additional input before publication. Comments and feedback were incorporated, and the final report has been posted on the ARCUS project website (https://www.arcus.org/meetings/2021/arctic-youth-stem), shared publicly, and submitted to the IARPC Arctic STEM Education Working Group (https://www.iarpccollaborations.org/teams/Arctic-STEM-Education-Working-Group), which will look at how the recommendations and key highlights can be distilled into actionable items. The IARPC Arctic STEM Education Working Group works to connect STEM education organizations that leverage Arctic science and includes both federal and nonfederal members. The IARPC 2022–2026 Arctic Research Plan includes STEM education as a foundational activity (https://www.iarpccollaborations.org/arctic-research-plan-2022-2026.html). The outcomes in this workshop report will be useful for federal planning.

Photo by Regina Brinker (PolarTREC 2014), courtesy of ARCUS.

1. Introduction

The Arctic is undergoing rapid and significant changes. These changes require communities to be aware, informed, and involved to able to address complex environmental, economic, and social challenges with their associated Arctic science, technology, engineering, and mathematics (STEM) needs. These challenges require a diverse workforce with different backgrounds, perspectives, and knowledge to develop responses to new and emerging issues. This workforce needs to be equipped to execute research and management mandates in an increasingly complex Arctic. Alaska STEM industries are growing, and there is a greater need for employees with university degrees, especially STEM postsecondary teachers and occupations in the life and physical sciences, architecture and engineering, and computers and mathematics. Alaska Natives are vastly underrepresented in these careers: while they make up 15% of the state's population and 10% of the workforce, they comprise only 6% of those working in computer, engineering, and science occupations. In Arctic Alaska, better representation of rural and Alaska Native undergraduate students in STEM programs is particularly needed to ensure the availability of a diverse Arctic STEM workforce.

To address this issue, the virtual workshop Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM was held April 13–15, 2021. The goal of the workshop was to bring together rural and Alaska Native undergraduates and youth, federal agency representatives, researchers on Arctic STEM projects, Indigenous faculty and staff, those from the private sector, and rural Alaska community members to discuss the gaps, challenges, opportunities, and successful practices to increase and support the representation of rural and Alaska Native undergraduates and youth in STEM education and career pathways. For this workshop, *youth* is defined as the age group or grade level of upper high school (sophomore to senior, approximately age 15 to 18).

The workshop was an initiative of the IARPC Arctic STEM Education Working Group and was hosted by the Arctic Research Consortium of the U.S. (ARCUS) with funding from the National Science Foundation (NSF PLR 1304316 and PLR 1928794). The International Arctic Research Center at the University of Alaska Fairbanks (IARC) was subcontracted to provide support for the planning and execution of the workshop. Workshop facilitation was provided by Alli Harvey of Information Insights, Inc., of Fairbanks, Alaska.

2. Workshop Organization

The virtual workshop Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM was held on April 13, 14, and 15, 2021, from 10 a.m. to 2 p.m. Alaska daylight time (AKDT) each day. While the workshop was originally planned as an in-person event for late spring 2020, the workshop was instead held online (via Zoom) in spring 2021 due to challenges associated with in-person meetings during the global COVID-19 pandemic.

The need for a workshop to address challenges to and opportunities for increasing rural and Alaska Native undergraduate and youth participation in STEM programs was first requested by the IARPC Arctic STEM Education Working Group in May 2019. At the invitation of IARPC, ARCUS undertook the role of coordinating the workshop and the events leading up to it. A steering committee was established to serve as a resource and give advice throughout the planning process. This committee was designed to be small but representative across different spheres to include researchers, education experts, STEM program affiliates, and Alaska Native undergraduate and graduate students. Workshop organization efforts received additional input and support from ARCUS staff, Information Insights staff, and IARPC advisors Dr. Kaja Brix of the U.S. National Oceanic and Atmospheric Administration (NOAA) and Elizabeth Rom of the U.S. National Science Foundation (NSF) (co-chairs of the IARPC Arctic STEM Education Working Group).

In preparation for the April 2021 workshop, four open listening sessions were held in early 2020, focusing on engagement of rural and Alaska Native undergraduates and youth in Arctic STEM programs. These Listen and Learn Sessions were held at the Alaska Marine Science Symposium in Anchorage on January 29, 2020; at the Alaska Forum on the Environment in Anchorage on February 11 and February 14, 2020; and via teleconference with Alaska Native Science and Engineering Pro-

Figure 1. Inupiaq Elder Dr. Elizabeth Fleagle, who opened each day of the workshop with a blessing. Elizabeth Fleagle is originally from Alatna in Interior Alaska and now lives in Fairbanks. Dr. Fleagle received her honorary doctorate in 2015 from UAF and is involved in many programs, including Social Work, Rural Human Services, and Rural Health. Read more about Elder Elizabeth Fleagle here: https://news.uaf.edu/fleagle-offers-wisdom-new-generation-students/. Link to video recording of blessing: https://youtu.be/gGL7wdSid1M. *Photo by Todd Paris, courtesy of UAF.*

gram (ANSEP) students in Fairbanks on April 7, 2020. A planned fifth session at the One Health Conference at the University of Alaska Fairbanks on March 13, 2020, did not take place due to the cancellation of the conference following the outbreak of COVID-19. In total, about sixty people attended the Listen and Learn Sessions.

The main themes emerging from the Listen and Learn Sessions were compiled and summarized in a report circulated before the April 2021 workshop, alongside draft guidance to help steer conversations and discussion points. This preworkshop report on the Listen and Learn Session outcomes is included in Appendix 2 (p. 30). The main themes identified from the Listen and Learn Sessions in 2020 included cost/benefit of participating in programs, accessibility, relevance, community engagement, long-term and post-program engagement, funding, outreach and recruitment, mentoring, and partnerships.

Additional materials were shared with participants before the April 2021 workshop, including a Glossary of Terms and Acronyms for Shared Understanding (Appendix 3, p. 35); a Code of Conduct and Rules of Respect, listing expectations aimed at maintaining a safe, welcoming, and trusted environment during the workshop; a list of relevant programs and resources on engaging youth in Arctic STEM (part of Appendix 3, p. 37, and available at https://www.arcus.org/meetings/2021/arctic-youth-stem#bootstrap-fieldgroup-nav-item--resources). The agenda (https://www.arcus.org/meetings/2021/arctic-youth-stem#bootstrap-fieldgroup-nav-item--agenda) was shared both in print and as interactive workshop guide with activities for all three days (Appendix 4, p. 40).

2.1 Workshop Participants

Seventy-three participants registered for the workshop (see Appendix 5, p. 45, for a list of participants). Workshop registration information was posted utilizing various social media and list serves hosted by ARCUS as well as leveraging the steering committee

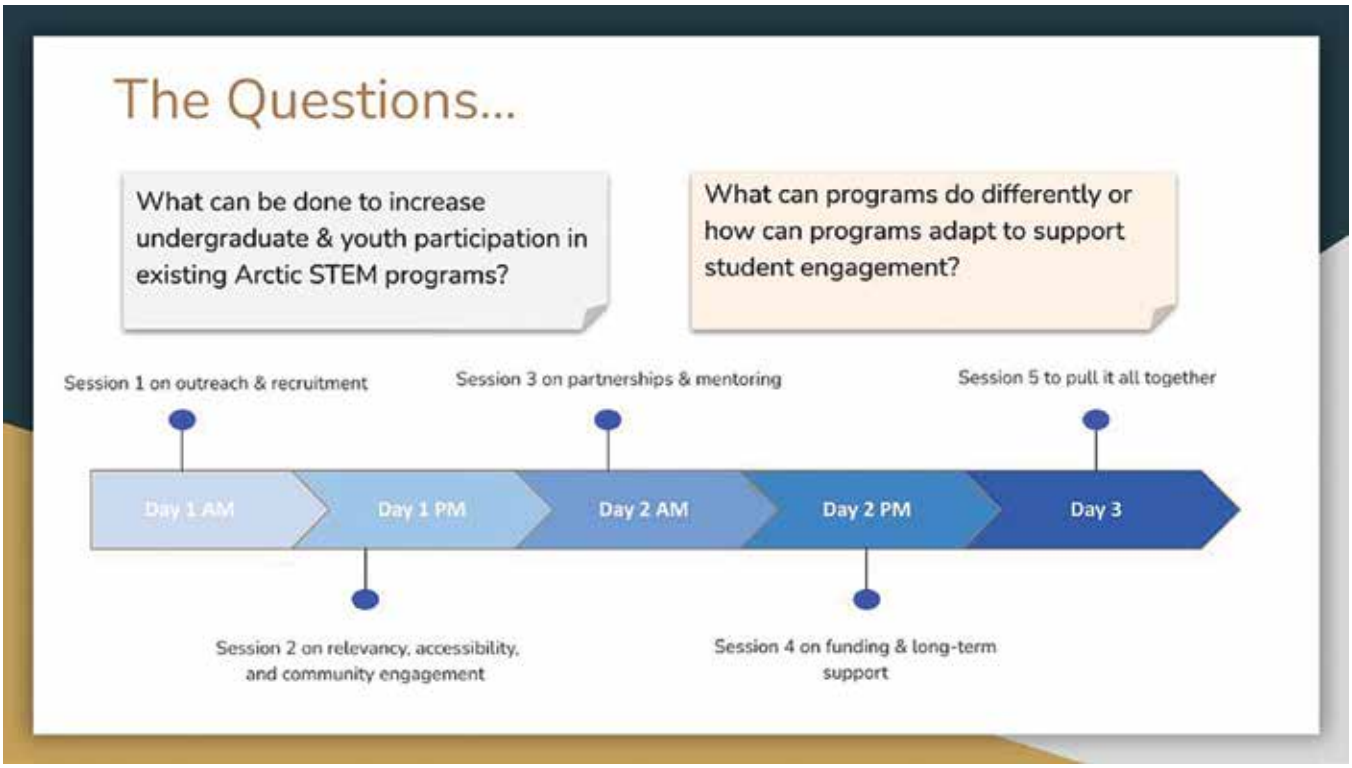


Figure 2. Workshop objective questions and structure *(ARCUS, 2021)*

networks. Individual invitations were emailed directly to potential participants who were identified by the steering committee or who had indicated interest during the Listen and Learn Sessions. The final list of participants included students, federal agency representatives, educators and education experts, researchers, and community members. Participants were encouraged to attend the entire conference. However, many participants had partial conflicts with other commitments, but still took advantage of the virtual forum to attend portions of the workshop. All participants were invited to give their feedback in a survey following the workshop.

2.2 Overview of Workshop Schedule

Each day of the three days of the workshop opened with a blessing by Alaska Native Elder Elizabeth Fleagle, a land acknowledgment by steering committee co-chair Amy Topkok, a review of the code of conduct, and an overview of the agenda. The purpose of including this suite of welcome activities each day was to establish a firm foundation of inclusivity, safe space, and shared understanding for all participants, including those who were only able to attend the second or third days of the workshop.

Plenary sessions as well as small breakout room sessions were offered each day. Each breakout room included a dedicated notetaker and facilitator as well as roughly six to ten participants. Breakout room assignments changed with each session so that participants had the opportunity to meet and network with a larger number of co-participants. Notetakers captured the discussion using a real-time whiteboard tool called Mural. To ensure privacy, participant comments were recorded in the notes without any identifying information. Plenary sessions followed each breakout session, where facilitators reported on their group's key takeaways and recommendations.

Following the welcome activities, day one began with an overview of the workshop philosophy and goals by Janet Warburton (ARCUS) and IARPC Arctic STEM Education Workshop Group co-chairs Kaja Brix (NOAA) and Lisa Rom (NSF). ARCUS staff and workshop facilitator Alli Harvey (Information Insights) provided an overview of the workshop agenda, Zoom platform, and ground rules of workshop communication. Following this, Janet Warburton and Amy Topkok reviewed the outcomes of the Listen and Learn Sessions and presented the workshop objectives:

1. What can be done to increase undergraduate and youth participation in existing Arctic STEM programs?
2. What can programs do differently or how can programs adapt to support student engagement?

Participants were next divided into five breakout rooms for breakout session one: Outreach and Recruitment. It was important to have smaller group engagement so as to ensure attendees felt they could freely share their ideas. After a brief break, participants were divided into five new breakout room groups for breakout session two: Relevancy, Accessibility, and Community Engagement. This was important for attendees to get to meet each other and also engage in a new group. The day closed with brief remarks from the workshop facilitator.

Following the welcome activities and a recap of day one, workshop day two began with breakout session three: Partnerships and Mentoring, followed after the break by breakout session four: Funding and Long-term Support. The day closed with brief remarks from the conference facilitator. Note that because all attendees were invited to

attend all three days, there were different attendees for most of the three days due to time restrictions on the attendees' part, so this enabled a greater number of comments to help address the main questions.

Following the welcoming activities, day three began with a review of days one and two by the workshop facilitator, including what had been learned so far and how it linked to the workshop objectives, and then shifted into breakout session five: Review, Refine, Recommend. This session focused on recommendations and how the recommendations address the larger questions in the two main conference objectives: *What can be done to increase rural and Alaska Native undergraduate and youth participation in existing Arctic STEM programs? What can programs do differently or how can programs adapt to support student engagement?* After this final breakout session, the workshop closed with a plenary discussion of reflections on the process, next steps, expected outcomes, and opportunities for community feedback and sharing.

Photo by David Walker (PolarTREC 2019), courtesy of ARCUS.

3. Breakout Sessions One to Four Key Takeaways

This section provides a summary overview of the discussions from each of the four breakout sessions during days one and two of the workshop. Discussions were captured by dedicated notetakers in each session using a tool called Mural. Each breakout session was also facilitated by a dedicated volunteer.

Key takeaways from these breakout sessions are compiled under various topical themes that emerged from both the Listen and Learn Sessions (accessibility, funding, outreach, mentoring, partnerships) and during the first two days of the workshop (relationships, research communities, exposure to STEM, developing STEM programming, investing in the community, respecting Indigenous knowledge and ways of being, and interagency/researcher coordination).

Breakout Session One: Outreach and Recruitment

Prompt: How can interested undergraduates and youth learn about Arctic STEM programming?

One breakout group focused their discussion on the importance of developing meaningful relationships between teachers, faculty, and students, and encouraged the practice of engaging students in existing STEM programs to serve as ambassadors during the recruitment process.

Another group stressed the importance of role models and relationship building both within school and outside of school, as well as structural challenges of education in Alaska including the quality of K–12 education, teacher retention issues, and lack of infrastructure (e.g., internet bandwidth).

A third group suggested outreach activities such as bringing scientists and graduate students into classrooms, with the caveat that these visitors must have an effective skillset for this type of outreach. Science fairs, scholarships, and help with recommendations and applications were also suggested. This group also suggested having broader community involvement in STEM outreach and recruitment and drawing on existing STEM programs as well as programming within the social sciences (which are often overlooked).

A fourth group highlighted the importance of making STEM relevant to communities and reaching out to a broader spectrum of students (beyond just the top 5 or 10%); this group also suggested encouraging related topics beyond the STEM fields, such as building good writing skills, which would have broad usefulness and applicability for students in all educational pursuits and other aspects of their lives. This group also

stressed the importance of role models to help students envision a personal path to an education and STEM career.

The final group pointed out that student peer engagement and information sharing was very effective. For example, word-of-mouth spread of opportunities from students who have participated in STEM programs is an effective recruitment tactic. This group also pointed out the structural hurdles of outreach and recruitment related to limited university administrative support for these activities.

Breakout Session Two: Relevancy, Accessibility, and Community Engagement

Prompts: What are some ways to ensure Arctic STEM programming and projects are relevant to place and community interests and/or needs? What are ways in which Arctic STEM programming and projects can be more accessible? What are respectful, honest, and consistent ways to engage with communities?

One breakout group stressed the importance of using a model of co-production of knowledge that includes community members in an equitable, nonhierarchical way to ensure that STEM programs are relevant to community interests and concerns. This demonstrates that a STEM education could contribute to a career that allows people to still live in their community, and would be an effective way to show that community input is important at the earlier point of design and engagement in programming.

A second group recommended consistency, thinking outside of the bubble, listening, the importance of outsiders sharing their personal side, connecting at the community and family level, and taking action to meet a community where they are (at local events, for example). These things must be sustainable.

Taking up this theme, a third group suggested collaborating with communities before the research starts, using a range of modes of communication, working with tribal organizations, and hiring locals. This group also stressed the importance of acknowledging your limits and not promising more than is feasible, as well as asking the community what they want out of a project.

A fourth group likewise stressed co-production of knowledge or co-designed research and discouraged "fly-ins" where researchers or program representatives come in with a set and inflexible agenda. It was suggested that programs or organizations give added consideration to thinking clearly about timing and to considering how family and seasonal or subsistence needs may overlap with program opportunities. Further suggestions included making sure to consider traditional and local knowledge and making sure outsiders learn about a community first.

The final group pointed out the gaps between science and community needs and suggested that cooperative research needs to be reciprocal. For accessibility to happen, there have to be flexibility, recognition that there are different approaches, and acceptance that colonialism has happened.

Breakout Session Three: Partnerships and Mentoring

Prompts: What are some steps and best practices to establish effective partnerships on Arctic STEM programs and projects? How can mentorship opportunities support undergraduates and youth? What does effective mentoring look like?

One breakout group stressed the importance of time, cultural awareness, and training and resources for people working with communities. Multiple mentors from different backgrounds are important: Alaska Native mentors, cohort mentors, and short- and long-term mentors offer different strengths.

A second group focused on longevity of relationships and establishing a pipeline in early grades in primary school that relies on community teachers as a jumping off point, though they pointed out that high teacher turnover is a hurdle to this. Tribal and administrator relationships can also serve this purpose. Long-term partnerships could benefit from a central clearinghouse, websites, cold-calling teachers and other community gatekeepers, and relying on personal relationships.

The next group stressed that partnerships need support, especially in small institutions with few faculty. This group reiterated the importance of knowing communities, people, and landscapes before beginning projects; outsiders should expose themselves to the culture and adapt. For remote villages that are hard to travel to, rely on other forms of communication to do this. It is also important to identify other researchers who are working on the same topic and coordinate so that communities and local educators are not spread too thin. Further recommendations included listening to students and treating them with respect, and engaging peer mentors.

A fourth group reiterated the importance of treating everyone as an equal and using transparent and honest communication about the goals of the partnerships. Time and patience are key; develop projects carefully with consultants, locals, and local and traditional knowledge and make sure not to force partnerships. Build personal relationships with the people, organizations, and communities you want to work with; find multiple ways of sharing, such as meals. Internships and real skill-building opportunities are important; do not just treat students as assistants. Rely on a range of mentors such as Elders and other community mentors, and include school staff if possible. Give mentors training and set clear expectations; give mentees opportunities to give feedback throughout the mentorship experience.

The fifth group suggested including different people in partnerships: precollege to university students, schools, tribes, Elders, and educators. To help partnerships flourish, this group suggested having sensitivity to people from the Arctic, as well as consistency, trust, honesty, flexibility, and reciprocity. Gaining consent throughout the duration of a project is key, and making sure to have good points of contact to sustain partnerships. Mentorships should be long-term relationships that are based on competency, accessibility, and shared or aligned philosophies between the mentor and mentee. Recognize that not everyone can be a good mentor. Acknowledge that weather and culture play a role in people's lives—stay flexible!

Breakout Session Four: Funding and Long-term Support

Prompts: How does funding (what, who, and how efforts are funded) impact the effectiveness of Arctic STEM programming designed for rural and Alaska Native undergraduate and youth? What practices should be in place to ensure undergraduates and youth are supported both before and after Arctic STEM programming or projects?

One breakout group pointed out that funding cycles often present a challenge for researchers to build and maintain community connections. There are also challenges to equitable access to both funding and pre- and post-project experience; some students may not even be aware of opportunities. Success of a program will look different to and be defined differently by funders versus students versus communities. Co-production of the opportunities themselves is a novel solution.

A second group reiterated that funding structures are not suited to producing long-lasting relationships and engagement. Shifting power and leverage to communities could be a solution. It is also important to consider the identities of rural students relative to funding opportunities; many of them will not fit typical eligibility requirements for programs, and rethinking funding requirements will open up opportunities to a broader group of students. Offering support before and after a program could be effective; funding opportunities should not focus only on program participation but also on relationship building, skill building, and basic training in things like writing or math. This also includes post-project activities such as data analysis, conference participation, or bringing participants in as funded mentors later on. Additionally, funding infrastructure and coordinating across agencies and activities will help longevity.

The third group highlighted the importance of funding administrative costs such as travel to rural villages and travel for students as well as researchers. Funding for an array of activities such as summer camps could be useful. Including food in a budget is important for assembling communities, and leaving resources behind after a program is finished can help students continue their achievements. Students and Elders should be paid for their work. Tracking students at the post-program stage would be useful; this could be written into a grant. Offering employment opportunities following a program and coordinating and tracking across organizations or programs could benefit students. Make sure to offer opportunities outside of summer, which is often subsistence time, or shorter intensive opportunities during the regular school year, for example.

The fourth group suggested offering course content relevant to emerging topics such as climate change, so that teachers can become more involved in these new ideas. Helping students with applications (e.g., applications to jobs, programs) long before deadlines would be helpful for students as well as support them in their efforts to follow-up on the opportunities. The traditional three-year funded grant programs do not typically allow for long-term relationship building, and funding sources should consider other practices for building longevity in relationships. Opportunities for students and communities to exchange ideas and funding sources would be useful. Infrastructure development that uses both science and local and traditional knowledge from Elders can fix problems and help bring funding into the region. An awareness of discrimination within the STEM fields is key; women especially need support systems. Services for rural and Native students are important for linking students from similar backgrounds with each other; this builds a support network and creates a cohort model.

The fifth group reiterated the inequalities in funding with large organizations and institutions. High costs (financial and time) and challenges associated with research in Alaska and in rural areas are often not accounted for; grant review should include people who understand this. Funds should be included for student participation, especially if they must forego paid work to participate. Mentorship should be funded. Attention must be paid to the timing of opportunities: for example, if internet access is intermittent allow for extra time if needed. Expectations should be clearly expressed to students at the beginning of an opportunity, and students should be provided with safety training and necessary gear during fieldwork. An alumni network and student-to-student networking would be useful; mentorship should be consistent, and students should have opportunities to share their feedback on programs. For students who need more training to qualify for participation, exceptions to requirements could be made.

The content above and related concrete ideas from the breakout sessions were compiled at the end of day two and sorted thematically by steering committee members and facilitators into the following categories: accessibility, funding, outreach, role modeling and mentorship, partnerships, relationships, research communities, exposure to STEM, developing STEM programming, investing in the community, respecting Indigenous knowledge and ways of being, and interagency/researcher coordination (see Table 1).

These categories were drawn from themes that emerged among material generated during the Listen and Learn Sessions and days one and two of the workshop. This list of key takeaways was presented back to the workshop participants prior to day three. This provided the foundation for the final breakout session targeting the two main workshop objectives: *What can be done to increase undergraduate and youth participation in existing Arctic STEM programs? What can programs do differently or how can programs adapt to support engagement?*

Table 1. Overview of Key Takeaways from Workshop Days One and Two

Theme	Key Takeaways
Accessibility	• Understand the identity of rural students when considering funding projects and eligibility for them; rural students do not always fit the typical eligibility requirements for programs. • Funders must consider and grant allowances on *how* funds are used (e.g., travel, stipends, food, extra trips related to community building, resources for students after the program, paying Elders, etc.). • Have well-respected community members and youth leaders take initiative on the program (if they want to). Some students do not like the school's environment, so reach through the schools may be minimal. Make these programs more inclusive—throw away the GPA requirements and class standings—these do not define a student, especially in a system that is already oppressing Indigenous students. It only takes one good experience and opportunity to inspire an individual—the actions, encouragement, and support are what leads students to pursue their career interests and succeed. • Recognize that most rural and Alaska Native students are going to be "nontraditional" students. • Recognize the discrimination faced by some entering the STEM fields, especially by women. • Gender issues: women need more support systems; there needs to be more gender-inclusivity and sensitivity training offered.
Funding	• Recognize that lack of adequate funding or rewards does not help build trust-based relationships. • Provide scholarships. • Funders: if you can't offer something, find another partner who can offer it when possible. • Advertising funding sources (both to fund projects and to support students in projects) is critical. • Consider longevity and funding cycles because they are related to relationship building. • Wherever possible, shift funding to communities so they can make the decisions. • Even after a project or program is over, continue to share results and how the funding is/was used, and keep people engaged. • Shift power and leverage to communities. • What/who/why of funding is integral to relationships with communities and students and must be equitable.
Outreach	• Reach out in many ways: community sharing, teachers, newspapers. • Reach out to students who are beyond the top 5 to 10%, who may have different skills in STEM fields. • Use different forms of communication to ensure consistent and regular communication; TikTok or short messages could be effective for reaching more people, but also recognize the internet is not always reliable. • Engage the schools and teachers differently; offer cultural camps. • Consider the timing of offering opportunities in research—maybe not in summer when students go back home, or find out if they are already taking classes. • Offer opportunities outside of summer for students who find that a tricky time of year for participation. • Use different modes of communication with remote villages that are hard to travel to (Zoom, telephone). • Do not walk into a community expecting engagement and results. Form a positive relationship with the community, gain trust, and let them know you are here for them and not your job title. Show up, work with the community, be consistent, follow through, and follow up. Hand over the microphone and listen. Your job is to uplift voices by using your platform to create positive changes and action. • Provide ways for students in STEM programs to be ambassadors to help with recruitment.

(continued on next page)

Table 1 (continued)

Theme	Key Takeaways
Role modeling and mentorship	• Support role modeling in communities to help people see themselves in opportunities—professors, teachers, parents, and peers: "I'm here, but there are people over there in college. How do I see myself able to get there?" • Peer-to-peer through student engagement: one student who went through ANSEP opened up doors for other students. • Think about mentoring opportunities outside of a structured mentoring approach. • Create mentoring opportunities at different timelines (one-off, short, and long-term). • Foster student relationships with more than one mentor. • Help students build mentorship relationships with at least one Alaska Native mentor who understands cultural backgrounds and inequalities. • Foster cohort mentoring. • Offer class-based mentorship in school settings. • Start building mentorship relationships at early grades to create a pipeline to STEM education and careers. • Build peer mentoring opportunities to help with other mentor issues or problem solving. • Create multiple mentorship opportunities: count on Elders, community members, and educators as mentors. • Train mentors and set expectations at the beginning of the project. • Check in with mentees at beginning, middle, and end of mentorship experience to understand what works, what does not, and what improvements can be made. • Foster student-to-student mentorship opportunities. • There can be one-off mentor relationships, but really the mentorship idea captures longer term relationships. • Select mentors who are competent, accessible, and have a philosophy that is in line with the students'. • It is difficult to find a good mentor; not everyone can be a good mentor. • Build networks to support each other and create a cohort model. • Need to recognize and develop role models (e.g., more peer role models and support as students move higher up in their education). • See current participants as future mentors.
Partnerships	• Work with tribal organizations. • Take the time to build effective partnerships. • Promote longevity by creating partnerships with teachers in communities. • Offer support for partnerships, especially for those with small institutions with limited faculty. • Practice transparent and honest communication about what can be learned and developed and what the goals can be of the partnership. • Do not force partnerships, even though an entity or program may have very good goals. • Develop different types of partnerships: personal relationships with members you want to work with as well as formal partnerships with communities and organizations. • Create partnerships that include different teams of people (precollege to university students, schools, tribes, Elders, educators). • Use consistency, trust, honesty, flexibility, and reciprocity to help partnerships flourish. • Include good points of contact so that partnerships do not break down. • Offer course content relevant to newer research ideas (such as climate change). Offer those to teachers so that they may be involved more in that arena.

Theme	Key Takeaways
Relationships	• Develop meaningful relationships with teachers, faculty, and students. • Building trust and establishing buy-in requires engagement with people within communities. • Use technology such as social media and radio to communicate opportunities, but best to develop meaningful relationships through honest and trustworthy communication. • Build relationships and engage the community as a whole: learn what is important to the community and understand the students and their needs. • Be consistent in communication with the community throughout the process. • If you are a researcher or a PI of a grant or a program, share yourself—all of yourself as a whole person (the personal side of who you are as an outsider) to allow the community members to get to know you better. • Connect with the community and community members at the family level. • Meet with the community members at their level, in specific events and meetings (listening with intent can help with this). • Be flexible to allow accessibility to happen. • Cold-call and build on personal connections to build relationships with teachers. • Get to know the students and respect them. • Treat everyone as an equal. • Have patience; building the relationship takes time. • Organizations need to build trust with the community and do their research about the community before entering it. They need to ask the right questions, attend meetings in the community, and constantly work with the community. Let community members take the lead on the project and programming.
Research Communities	• Recognize challenges unique to Alaska: quality of K–12 education, teacher retention issues, geography, lack of infrastructure (internet bandwidth, etc.). • Educate and train teachers to recognize implicit bias and understand the history and impact of colonization: "transform STEM to be a field that is inclusive and welcoming for students. So not just how do we reach out, but how do we ensure that we're bringing students into an environment where they can bring their whole selves (and isn't assimilatory)?" • Examine systems in place in a community that maybe do not allow those in rural and Alaska Native populations to succeed. Consider if higher education institutions, programs, and/or grant funding organizations can be deconstructed to find ways to allow for flexibility, goals to be iterative, budget for internships and apprenticeships for greater success. • Understand what is happening in a community before you offer a program or a position. • Learn from past experiences. • Accept that colonization happened but recognize that equity can still be achieved. • Build cultural awareness of communities. • Provide people (scientists, researchers, instructors) with access to training and resources for understanding and working with communities. • Know communities, people, and landscapes before projects. • Put yourself in someone else's shoes; expose yourself to the culture and adapt to the culture (e.g., go to basketball games in Utqiaġvik). • Be sensitive to the unique context of Arctic peoples.
Exposure to STEM	• Bring scientists and graduate students to classrooms. • Elevate science fairs and other opportunities/exposures. "Career fairs are costly but effective." Host local career fairs with Native corporations and/or local organizations. • Piggyback on existing regional career fairs. The local community development quota (CDQ) programs usually are very involved in the local/regional career fairs. • Cost savings model: share material with the one or two people who are attending regional career fairs so they can give their materials to those college recruiters who can travel.

(continued on next page)

Table 1 (continued)

Theme	Key Takeaways
Exposure to STEM *(continued)*	• Provide funding to pay for students' travel and lodging from rural communities for career fairs and other opportunities. • Connect scientists with youth. • Create internships that help create mentorship opportunities, foster STEM interest, and build real skills. • Provide skill-building activities in writing and math. • Developing alumni network through social media, etc.
Developing STEM programming	• Work with communities and community members from the start, using a co-production model, so they have an equitable (nonhierarchical) seat at the table. Co-production of knowledge involves the community members in what they want. • Involving the communities also allows them to contribute to STEM programming goals and objectives and make those goals relevant to the community's interests and concerns. • Involve a community's K–12 teachers in the goals of a STEM program to ensure they are aware of the bigger picture. This allows the teachers to be engaged and involved in the community, which is a benefit to the community. • When developing program goals, engage the community as an equal partner. • Demonstrate that STEM education could contribute to having a career in STEM while still living in the community. This is a positive way of showing the community that this is possible and is respectful of the community's input, which is important. • Keep the STEM programming relevant to the goals of the community. • Think outside of the bubble: consider other factors when going through the development process. • Listen with intent. Prove that you have been listening by taking their input and making it actionable and concrete towards the community's goals; make it a reality. Identify the needs of the community. Research is not a one-way street. • Realize that success is not a straight line and adjust accordingly. • Collaborate with the community before starting your research project. This means engaging and asking them what they would like to research and how do they want to be involved from the start. • Do not promise too much; be realistic and up front with communities and let them know of your limits. • Allow communities to co-design the research project before the research is funded. • Ask how citizen science and community needs can be brought together. • Cooperative research needs to be reciprocal; each must have benefits that all groups agree upon. • Goals and objectives need to be throughly thought out; processes in institutions or organizations need to be considered. • Embrace changes and allow for flexibility. • Recognize different approaches to achieve the same goals. • Drop the agenda at first meeting and instead ask: what can we do together, how can we develop this, is this something you actually want to be partners on? • Get verbal consent for the duration of the project. • Opportunities for STEM education should not just offer opportunities to students but should also contribute to the broader community. • Offer opportunities for participants/students to provide feedback to programs. • Not so much emphasis on structure, mentoring approach, or timeline.
Investing in the Community	• Make actionable items sustainable so that they continue even after the program or grant funding ends. • When conducting research in a community, consider local hires. • Build longer term platforms (clearinghouses, websites) to outlast individual connections with teachers. • Build relationships with tribal organizations and administrators in communities to offset the challenges of high rates of teacher turnover.

Theme	Key Takeaways
Investing in the Community *(continued)*	• Talk to key people and help them organize community meetings. • Coordinate and track students to help with post-program follow-up and program longevity. • Contract with communities (e.g., paying community members to participate, hire community members to support the research, have written agreements for partnerships.) • Offer employment to students after the program. • Foster or support ways for students and/or community to continue to exchange ideas after the program. • Provide expectations and safety training and gear during fieldwork to students.
Respect Indigenous Knowledge and Ways of Being	• Do not rely heavily on only westernized organization processes. Consider local and traditional knowledge practices. • Consider seasonal and/or subsistence needs. Have more shorter intensive classes during the regular school year. • Consider traditional knowledge or local knowledge; this can help design projects or programs so that they are better coordinated with the region's needs. • Develop projects carefully and consult with people who have local and traditional knowledge. • Do not offer just one way of sharing—include other ways, such as meals. • Stay flexible and bear in mind that the weather and culture are always going to come first in people's eyes. • Recognize the power of "community" and its role in both funding and long-term support for students (e.g., local and traditional knowledge can help bring funding into a region). • Summer is subsistence time. Come up with more winter opportunities. *Steering Committee Note: Subsistence occurs outside of summer as well. For example, whaling seasons are in fall and spring and involve entire communities, including youth and college students. STEM programming should coordinate with subsistence activities throughout the year.* • If K–12 science education was grounded in place-based knowledge—the science developed over thousands of years here—and conducted as hands-on education was on the land, with outside teachers learning from the community, it could get lots of kids excited about STEM.
Interagency/ Researcher Coordination	• Researchers: foster and help with communication between Arctic STEM programs and communities. • Identify other researchers working on the same topic and collaborate with them so that communities and educators are not spreading themselves so thin. • Improve program coordination between various agencies and existing activities.
Additional Takeaways	• What happens outside of school is important. • Robust and coordinated university plans can serve as examples; UAF has the Biomedical Learning and Student Training (BLaST) program with a focus on rural Native students and the One Health program. Check out what ANSEP is doing already. *(See Appendix 3, p. 37, for more information on these programs.)* • Social sciences are part of the STEM field and are often overlooked; these programs want to engage students as well and want to encourage NSF to provide more funding for this. • Many colleges are two-year; try to get students engaged in research in these. • An example: programs that support youth by allowing them to own their own place and be the experts in their community. • Universities need more administrative support for outreach and recruitment. • NSF's convergent element may offer opportunities. • Identify that it is not a straight line to science; it is a circuitous pipeline.

4. Workshop Outcomes: Main Highlights and Recommendations

Breakout Session Five: Review, Refine, Recommend

Day three was centered on reviewing the key takeaways that emerged on days one and two and refining these into main highlights or recommendations (see Figure 3, p. 22, for visual notes contributed by workshop participant Sarah Crowley). Before the start of day three, the key takeaways, sorted into the thematic categories, were shared with all participants. In their breakout rooms on day three, participants were asked to focus on the two guiding objective questions to aid them as they refined their recommendations:

1. What can be done to increase rural and Alaska Native undergraduate and youth participation in existing Arctic STEM programs?
2. What can programs do differently or how can programs adapt to support engagement?

A nonprioritized list of recommendations that emerged from the breakout rooms on day three follows. This list was generated from key points identified by each breakout group, which were then shared back as main takeaways with the larger group. A large group discussion followed to expand and refine these takeaways for the final list of recommendations. For the preparation of this report, these recommendations have been synthesized and sorted into seven general themes:

- Increase early outreach and exposure to STEM.
- Define STEM broadly and inclusively to capture a wider group of students.
- Redefine how program objectives and success are measured to ensure they are relevant to students and communities.
- Draw on partnerships with multiple sectors and organizations.
- Shift power to students and communities.
- Remove hurdles to participation, including structural and systemic hurdles.
- Respect and include Indigenous knowledge and ways of being.

In the following pages, each theme is followed by recommendations, and each recommendation is followed by ideas for implementation. These were generated by each group.

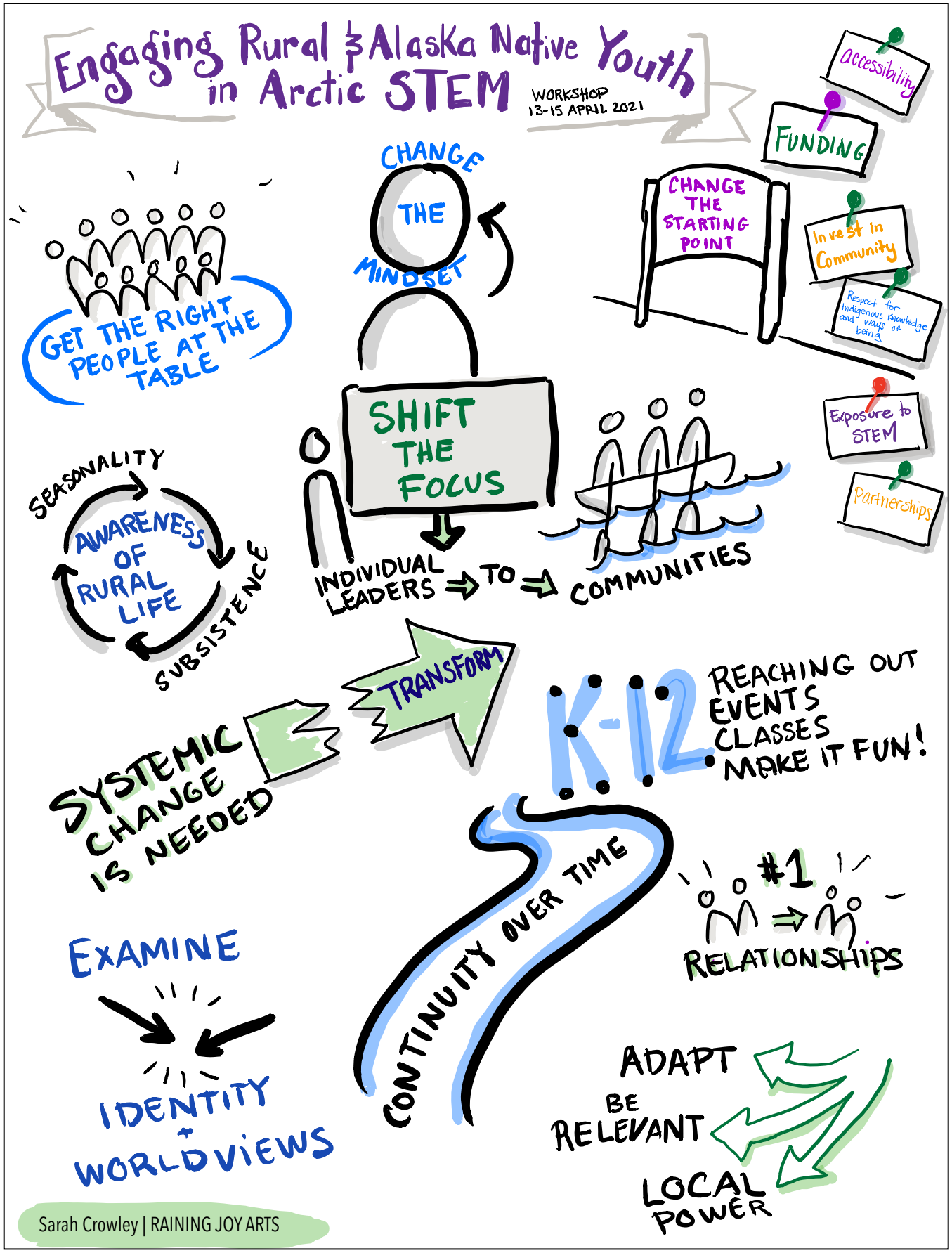
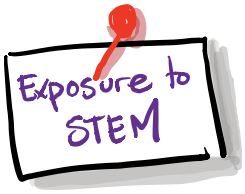


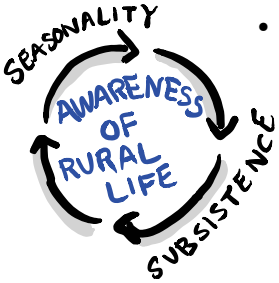
Figure 3. Visual notes of workshop outcomes by participant Sarah Crowley

Theme One: Increase early outreach and exposure to STEM



- Create more preparatory programs that address regional needs and diverse approaches.
  - *"We need to prepare students before they go to STEM. Social emotional learning skills, resilience, how to deal with failure, self-identity."*
  - *"…training programs for students to help them see why they need those things (like math, writing). NOAA Hollings prep program is an example."*
- Engage more with high-school freshmen and younger students; existing programs mostly target sophomores and juniors.
- Increase personal engagement and communication. Pay more attention to how we are actually accessing students.
  - *"Look at the numbers to determine what is most effective for advertising."*
  - *"Social media outreach is more effective than a poster."*
  - *"Do a media blitz for advertising and determine how the students find out about the program."*
  - *"Include science booths outside of local or regional events (a basketball tournament, for example). Travel costs are high, so if you already have students coming into a village, use the opportunity to engage with students at that time."*
  - *"Identify reliable sources to engage with students. Teachers may not be the most reliable source because of high turnover. Use social media, which can be appropriate and adaptable (since it changes quickly), and radio."*
  - *"Talk to the students in the community to find out where they are getting their information. Ask students what should be done."*

- Integrate research into courses in the K–12 system; incorporate citizen science. Make courses relevant to place and culture.
  - *"Integrate research right into a course."*
  - *"Students have wondered about service to the tribal community, courses that tie in relevance to place (terrain), and…subsistence topics…."*
  - *"Include high-impact practices that have connections to their culture."*
  - *"Have a research-intensive workshop in middle or high school to introduce students to these fields earlier."*
  - *"Make K–12 science classes locally oriented (instead of dissecting frogs, for example, dissect herring or hooligan or something local)."*

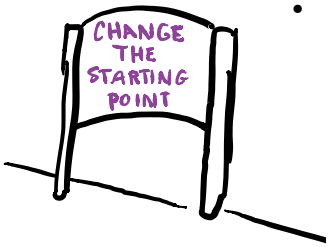


- Time outreach activities appropriately throughout the year, being sensitive to subsistence and/or yearly events already occurring in communities.
  - *"Provide funding for outreach activities besides just in the summer, when so many researchers head to the communities to do research."*
  - *"Embrace the academic year. Include funding in grants for researchers to come back at times outside of their main summer research period."*
  - *"Have fun, engaging activities throughout the year."*

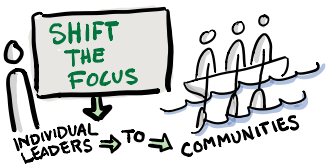
Theme Two: Define STEM broadly and inclusively to capture a wider group of students

- Use a broader definition of science and STEM. Be more holistic and have social sciences and humanities integrated. Do not just focus on STEM fields on their own.
  - *"Social sciences should inform more STEM programs."*
  - *"STEM and engineering need to listen to humanities and social sciences. And this is a transformation we need to drive from the university out to society."*
- Avoid gatekeeping in science. Make sure an inclusive definition of science is used so that social science and Indigenous knowledge are not excluded.
  - *"Science is gatekeeping—when we have conversations about STEM and social science, it is letting people know that social science is not STEM. Also, when we talk about Indigenous knowledge and science. This is gatekeeping."*
- Encourage finding ways to integrate STEM identities and Indigenous identities.
  - *"Are the Indigenous youth thinking: will they lose part of their identity if they take on a career in STEM?"*
  - *"We need messages from those in STEM fields to tell youth that they can be both Indigenous and have a career in STEM."*
  - *"Ask: How is it to have an identity in a STEM field and also be an Indigenous youth? (How) do these things work together? Do they see themselves like this? Can this be encouraged? Students may feel they lose identity if they leave their communities. Create, or support the creation of more jobs in the community."*
- Assist and create programs for students who do not have a high grade-point average. They need an entry point.
  - *"Broaden programs to those not in top of the class, or who may not know yet about STEM."*
  - *"Reframe programs to reach at-risk students: these are often those who are active in subsistence and are the natural scientists in the communities."*
- Encourage students in a variety of programs besides just in STEM. Include the social sciences so that some blending can occur for those with those interests.
  - *"It is important to open opportunities up to non-STEM majors. Some have no idea what they could do with STEM. Give opportunities to those NOT already in STEM."*
- Consider the needs of nontraditional students.
  - *"Important to help in increments . . . finish high school, then college, then beyond. Bridge programs are important because students may not be able to see the whole career view."*
  - *"Create more part-time positions for those who cannot be full-time students or STEM workers. This could help them enter an area they may not have thought of themselves going into. "*
  - *"Accommodation for part-time students. . . . Some have other needs that can take time away from the regular school calendar."*

Theme Three: Redefine how program objectives and success are measured to ensure they are relevant to students and communities



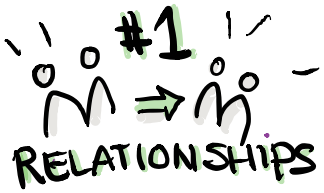
- Make sure scientists, researchers, and STEM program leaders ask themselves: What is the purpose of what we are doing? What are the intended and actual outcomes? What do we see students doing, and where do we see them going, after? What are their opportunities and desires, and needs in communities, and how can we align them better?
  - *"Programs…need to recognize that they…might serve as a stepping stone that students need to engage in other career paths or areas of interest that are highly individualized."*
  - *"Programs need to rethink definitions of success and failure."*
- Skills needed to conduct scientific work are varied; make sure that the skills students gain are applicable to other aspects of their lives.
  - *"What kind of skills do students need?…We need to name those."*
- Shift away from individual thinking and more toward communal/community thinking.
  - *"Programs are geared toward individual participation. Community and place can play a larger role in these programs."*
  - *"If the rest of the community is receiving the benefits back, it can build enthusiasm and support for a program."*
  - *"Grow opportunities for youth in their home and using the skills that they acquire elsewhere."*
  - *"Can the university work with elders and community leaders to talk with students about what they need and how to see future opportunities?"*
  - *"Community-based research projects that utilize art to express research questions and results have been very successful."*



Theme Four: Draw on partnerships with multiple sectors and organizations

- Create more partnerships with industries.
  - *"Organizations benefit from education that the university provides to students. Funding comes from those entities. This is a potential model."*
- Work more with existing programs (Rural Alaska Honors Institute, Society for Advancement of Chicanos/Hispanics and Native Americans in Science, Upward Bound). Continuity in/across programs is important.
  - *"data collected by the community or student before he or she arrives could be used."*
- Create a website repository of available programs across Alaska for educators and students, so that programs are easier to access.
  - *"this could allow advisors/mentors to create an informational campaign."*
  - *"Would be good to have a list of contacts for different programs (to easily find out information such as application deadlines, etc.)":*
- Encourage better collaboration among STEM programs and organizing entities.
  - *"Would be great to partner programs that support Indigenous youth when they head to school and that those students could then be recruited for jobs/internships."*

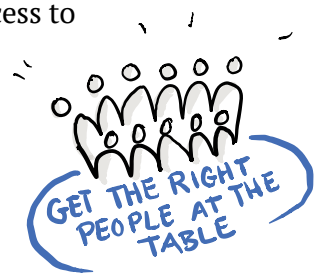
- *"Programs within NOAA collaborate between offices which is great but would be even better if it were between programs from multiple funders."*
- *"Another idea to bring organizations together—coordinated Zoom events to invite multiple organizations. Use breakout rooms to have them discuss with each other."*



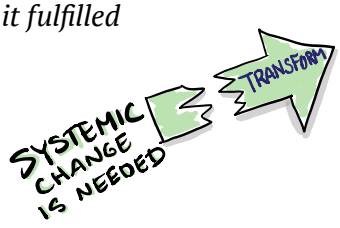
- Work with local Alaska Natives and Native organizations (nonprofit and for-profit) to get better input early on in designing and/or maintaining available programs or grants.
  - *"Contact for-profit Native corporations for assistance, discussions, and potential data for students to use based on his or her area."*
  - *"Establish subsistence—science working group(s) within Native for-profit and tribal organizations, Arctic Research Consortium of the United States, IARPC, and maybe university departments so that subsistence specialists have an opportunity to discuss needs from a community perspective."*
- Help agencies and organizations that work in Alaska but are not based here to get here so that they can get an Alaska perspective on Alaska work.

Theme Five: Shift power to students and communities

- Move power to communities by engaging and involving them early in designing programs and/or funding opportunities.
  - *"Funnel funding for communities to distribute. Let communities decide where the funding goes."*
  - *"Involve community members in running of the program."*
- Make sure the right people are at the table. If needed, slow down the process to make sure the right people are there. Plan carefully to include extra time that may be needed.
- Increase representation in decision making, recruitment, and funding.
- Change the starting point of projects so that students, along with communities, drive what projects look like.
  - *"There is a lack of student engagement in initial solicitation. Youth in communities themselves could solicit the programs they would like to see."*
  - *"This would give youth more buy-in in the programs. We have to give authority to youth themselves to drive what these programs are going to be."*
  - *"Flip the script on the RFP request for proposal process: rather than the programs determining things, let communities make the request and have it fulfilled by programs."*



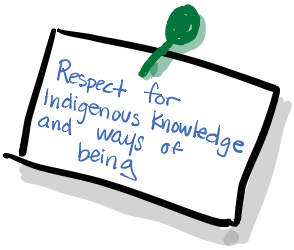
Theme Six: Remove hurdles to participation, including structural and systemic hurdles



- Include more thought about and discussion around systemic issues.
  - *"Teacher turnover can be a big problem in the villages/communities."*
  - *Job access: "Show students that they don't have to leave their village to follow the career they want."*
- Provide more internet access and bandwidth in communities.

- Incentivize programs so that students want to and are able to participate. Provide livable wages.
  - *"Pay them as well as you would an internship/job with a multinational oil and gas company."*
  - *"Some students have commented that if you get a degree, you could end up making less money than going right into the work force (for example, North Slope oil and gas work)."*
  - *"It is good for students if they can make a livable wage and can do science in their communities, not just collecting data."*

Theme Seven: Respect and Include Indigenous knowledge and ways of being



- Make relevancy a primary goal and make sure diverse worldviews are considered.
  - *"Relevance is the key. It can be difficult for local people to see what the relevance of the university is for their life. . . . Switching from subsistence life to university life is difficult. Very different worldview. Local/traditional knowledge versus western knowledge. Bring down the academic barrier. Knowledge and intelligence are not the same thing. Bring local/traditional knowledge into the curriculum."*
  - *"Meet people where they are. Many home-grown scientists are hunters/fostering information over a millennium."*
- Be aware of and work flexibly around seasonal subsistence activities and timing, so that students have the capacity to participate in these activities.

5. Workshop Follow-up and Next Steps

A post-workshop survey was distributed to all attendees requesting their input on workshop organization, length, preparation, presentation, staff, general participant experience, and any additional thoughts that participants wanted to share. Twenty-five participants submitted feedback through this mechanism. Feedback was generally positive and criticisms that were submitted were constructive. A few suggestions from the survey are highlighted below:

"Would have liked to see more [Alaska] Native participation and maybe more participation from youth [undergraduates] as well for their perspective!"

"We might have discussed why STEM is important in the larger context, perhaps drawing from the national STEM strategy."

"[We] could have had a summary of existing evaluation research or education reports… about STEM programming with Indigenous populations or reports produced by Indigenous entities… reviewed and [presented] this information for background to get attendees 'on the same page.'"

"I think the group could have had more representation from communities and villages in the Arctic. I know there were some limitations and changes due to COVID; however, I think it would have been really valuable."

"… formal feedback or presentations from Alaska Native community members and especially students would have been amazing."

"… boosting AK Native participation in these types of workshops is essential (although I also believe that the organizers are well aware and took active steps to reach the level of representation in this event)."

Some key things that participants learned and found valuable in the workshop are included below:

"[I learned that] a lot of the difficulties I face as a researcher in meeting the best practices of doing research in the Arctic stem from systemic issues with the power structure rather than an incompetence on my part. Knowing this is a game changer because instead of trying to figure out what I'm not doing right, I can instead focus on how to devise workarounds that shift the power dynamics in my interactions with Arctic communities."

"… programs like BLaST and ANSEP have been so successful already. They are a good foundation for the future."

"Tribal self-determination should be driving what the STEM needs are in each community rather than government and university entities offering STEM programming based on external perceptions of the needs of Arctic youth and communities."

"Build relationships at the local level—just because we've built it, they won't necessarily come. [We need] to find a common dialogue between what we are doing and how it ties into the interests of individuals and communities."

"Measures of effectiveness and success used by funders may be mismatched with their target recipients and limit the actual effectiveness of programs on the ground."

"I learned that in addition to establishing long-term relationships and partnerships with communities, to really engage with youth, creating fun short activities is really powerful."

"There is a growing consensus on transforming Arctic research and education—I felt like I have allies!"

A draft of this workshop report was submitted to the steering committee, workshop participants, and broader community members for review and to solicit any additional input before publication. Comments and feedback were incorporated, and the final report has been posted on the ARCUS project website (https://www.arcus.org/meetings/2021/arctic-youth-stem), shared publicly, and submitted to the IARPC Arctic STEM Education Working Group (https://www.iarpccollaborations.org/teams/Arctic-STEM-Education-Working-Group), which will look at how the recommendations and key highlights can be distilled into actionable items. The IARPC Arctic STEM Education Working Group works to connect STEM education organizations that leverage Arctic science and includes both federal and nonfederal members. The IARPC 2022–2026 Arctic Research Plan includes STEM education as a foundational activity (https://www.iarpccollaborations.org/arctic-research-plan-2022-2026.html). The outcomes in this workshop report will be useful for federal planning.

Photo by Susan Steiner (PolarTREC 2012), courtesy of ARCUS.

Appendix 1. Acronyms in This Report

ANSEP	Alaska Native Science and Engineering Program https://www.ansep.net/
ARCUS	Arctic Research Consortium of the United States https://www.arcus.org/
BLaST	Biomedical Learning and Student Training program https://blastak.com/
GPA	grade point average
IARC	International Arctic Research Center https://uaf-iarc.org/
IARPC	Interagency Arctic Research Policy Committee https://www.iarpccollaborations.org/index.html
NOAA	National Oceanic and Atmospheric Administration https://www.noaa.gov
NSF	National Science Foundation https://www.nsf.gov/
RAHI	Rural Alaska Honors Institute https://www.uaf.edu/rahi/
SACNAS	Society for Advancement of Chicanos/Hispanics and Native Americans in Science https://www.sacnas.org/
STEM	science, technology, engineering, and mathematics
UAF	University of Alaska Fairbanks http://www.uaf.edu

Appendix 2. Preworkshop Report on Listen and Learn Sessions

Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

April 13–15, 2021

Summary on Emerging Themes from Listen and Learn Sessions

https://www.arcus.org/meetings/2021/arctic-youth-stem#bootstrap-fieldgroup-nav-item--products

The following summary articulates the main themes that emerged from the facilitated Listen and Learn Sessions held in 2020. These listening session themes are guiding the framework of the discussions in the online 2021 workshop Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM.

Input from the Listen and Learn Sessions were grouped into overarching themes. The key themes that emerged were:

- Cost/Benefit of Participating in Programs
- Accessibility
- Relevance
- Community Engagement
- Long-Term and Post-Program Engagement
- Funding
- Outreach and Recruitment
- Mentorship
- Partnership

Below is the input that was gathered during the Listen and Learn Sessions. Draft guidance, summarized by the organizers, are listed below each theme. This information is just the start of the discussions and doesn't represent any final product.

As you go through this information, think back to your own experiences and let us know what is missing. Think about the drafted guidelines. Do the drafted guidelines capture the essence of the issues? If not, what additional guidance is needed? Are the guidelines and ideas clear? If not, how can they be better defined? Feel free to email your suggestions and/or feedback to ARCUS Project Manager Janet Warburton, warburton@arcus.org.

Cost/Benefit of Participating in Programs

Input from Listen and Learn Sessions:

- Provide competitive funding for students who come from lower-income families and are participating in a program instead of being paid to work.
- Understand that when a student leaves their community to participate in a program, you are removing a pillar of the community—students often support their families and communities financially and otherwise in the summer.
- Make academic credit available for students participating in programs.

Draft guidance: Evaluate the cost vs. benefit of participating in programs, not just for the participant but for their community (financial and otherwise). Make adjustments to the program and incentives accordingly.

Accessibility

Input from Listen and Learn Sessions:

- Create local opportunities and bring STEM programs and opportunities to communities to not add to the exodus from communities.
- Ensure that programs are open to nontraditional students.
- Connect with programs that support younger students so that students are prepared when they enter into undergraduate programs.
- Assess applicants on more than just GPA and written applications. Include things like letters of community support, community service history, and face-to-face conversations.
- Make program timing flexible—most programs are outside of communities and last the duration of the summer. It is hard for students to leave for the whole summer because of subsistence needs and practices.
- Have programs at different times like winter—it gives students something to do in winter when it is dark; summer is for subsistence and winter could be good for mental health.
- Offer options for remote connection and participation.

Draft guidance: Ensure that programs are accessible to the demographic you are seeking to attract.

Relevance

Input from Listen and Learn Sessions:

- Use community-relevant concepts and challenges and community-driven examples in programs and for projects.
- Use applied and hands-on examples from communities.
- Make sure that programs and training opportunities connect to pathways back to communities.
- Incorporate traditional/Indigenous ecological knowledge and values throughout the program.
- Include vocational trades and skill development in STEM programs.
- Include students and community members in the design of research projects.
- Acknowledge there are other ways of knowing.
- Understand what students' longer term goals are and understand that it is not just about getting students into Ph.D. programs.
- Identify areas of STEM lacking in communities and build programs around these needs.

Draft guidance: Make programs and projects relevant to place and community interests/needs.

Community Engagement

Input from Listen and Learn Sessions:

- Commit to long-term engagement with communities.
- Engage and integrate scientists and researchers who work in communities into programs and education systems.
- Incorporate traditional/Indigenous knowledge and community knowledge into programs and projects.
- Consider whole community and family when engaging a student.
- Honor students' existing roles in STEM in their communities.
- Ensure appropriate inclusion and compensation for local experts and traditional/Indigenous knowledge holders.
- Engage communities in the curriculum development and research questions.
- Consider how to engage students long term to keep them engaged in STEM.
- Engage communities through citizen science and environmental monitoring and connect back to program/projects.
- Ensure to the best extent possible that programs are run by Indigenous people, include Indigenous Elders, and that students are surrounded by other Indigenous students.

Draft guidance: Ensure respectful, honest, and consistent engagement with communities.

Long-Term and Post-Program Engagement

Input from Listen and Learn Sessions:

- Maintain relationships with students after the program.
- Engage younger students in programs so they are prepared and know what they need to do to fully participate in programs in the future.
- Create student cohorts so students can support each other both during a program and after the programs are finished.
- Continue to engage students after the program through activities like conferences, and help them connect to job opportunities and other active research opportunities.
- Ensure that students have the opportunities to provide feedback to programs they participate in.
- Help students identify and obtain their next opportunity.

Draft guidance: Engage students both before and after program.

Funding

Input from Listen and Learn Sessions:

- Fund scientists to do more face-to-face engagement in communities.
- Connect with organizations and agencies to sponsor students in programs.
- Consider how STEM programs are funded. If they are funded from out of state, how do they know what local priorities are? If funded by the state, how can they be protected from political fluctuations?

Draft guidance: Ensure adequate funding for programs and students.

Outreach and Recruitment

Input from Listen and Learn Sessions:

- Conduct contextualized and face-to-face outreach and recruitment in communities.
- Connect with people from rural Alaska who have STEM jobs as examples to students.
- Begin outreach starting at early age so students know what opportunities are ahead of them.
- Include rural campuses, vocational schools, and regional training centers in outreach and engagement activities.
- Engage students who have participated in programs to go back to communities and work with tribes and schools to do outreach.
- Advertise to the whole community, using public spaces like libraries, recreation centers, at community events, and schools.
- Work with teachers and guidance counselors to connect with students.
- Help guide students through the application process and ensure that students have enough time to work on applications. Students often need to use school internet to apply, so make sure that applications are not just open over holidays and breaks.

Draft guidance: Conduct targeted and community based (in-person) outreach and recruitment.

Mentoring

Input from Listen and Learn Sessions:

- Set up near-peer mentoring, where older students mentor younger students.
- Create peer-to-peer cohorts so students can mentor and support each other.
- Engage community Elders to be mentors.
- Consider options for preprogram mentorship to help students be prepared for the program.
- Provide options for mental health support.
- Ensure that social support exists for students to reduce culture shock, especially for students from rural communities separated from family support structures.
- Mentors should teach soft skills like public speaking and networking.

Draft guidance: Prioritize mentorship before, throughout, and after program.

Partnerships

Input from Listen and Learn Sessions:

- Partner with communities and tribal governments.
- Create opportunities for student exchanges between campuses and communities.
- Connect rural communities to each other to share STEM work, experiences, and best practices, successes, and challenges. This creates a community of Arctic STEM across the Arctic.
- Offer free training for jobs as a part of this (connected with potential employers).
- Establish employer partnerships so students can be deliberate as to what they are working towards.

Draft guidance: Connect and partner with community organizers and employers.

Appendix 3. Glossary of Terms and Acronyms for a Shared Understanding

The following are terms that may be used during the workshop. We will refer to them often, and we are here for your benefit. If you feel any of these terms do not apply to any discussion, please let us know. Contact Janet Warburton at warburton@arcus.org if you have any questions.

Terms

Alaska Native or Alaska Natives: Indigenous peoples of Alaska, United States. **Note:** The term "native Alaskans" refers to people born and raised in Alaska but not necessarily Indigenous peoples. All Alaska Natives are Indigenous peoples, but not all native Alaskans are Alaska Natives.

Arctic: The northernmost region of the Earth, centered on the North Pole and characterized by distinctively polar conditions of climate, plant and animal life, and other physical features. [Arctic | Definition, Climate, People, and Facts]

Colonization: (1) The action or process of settling among and establishing control over the Indigenous people of an area; (2) the action of appropriating a place or domain for one's own use. [Dictionary.com.] For the purposes of this workshop, we recognize that colonized practices of schools or institutions have influenced people to choose whether or not they enter into STEM fields.

Co-production of knowledge: Involving the community members in the process of developing the research project, or the process of how to go about their project so that all the stakeholders have an idea of what would be needed, but respectful to the community as well. [https://kawerak.org/co-production-of-knowledge-in-research-valuing-traditional-knowledge/]

Cultural relevance: Can be referred to as "cultural responsiveness," to include the ability to learn from and relate respectfully with people of your own culture as well as those from other cultures. [National Center for Culturally Responsive Educational Systems (2005).] For the workshop, we are asking for input that is culturally relevant to the many different regions of Alaska Native peoples and native Alaskans.

Decolonization: The action or process of a state withdrawing from a former colony, leaving it independent. [Dictionary.com] It is also decolonizing thought practices, of being able to recognize Indigenous points of view, and that these views are equal to western thought practices. "Describes efforts by Indigenous people to assert authority over representations of their own cultures." [University of Alaska Museum of the North: Decolonizing Alaska | Museum | Museum of the North]

Formal education: Formal education is a structured and systematic form of learning. This is the education of a certain standard delivered to students by trained teachers. To make sure formal learning is standardized, and all learning institutions (e.g., schools, colleges, universities, etc.) comply with these standards, formal education is governed by organizations. In the United States, the Department of Education oversees formal education in all states. [What is Formal Education?]

Informal education: Education often referred to as "experiential learning," or learning outside of formal education (school settings).

Racism (simple definition): Prejudice, discrimination, or antagonism directed against a person or people on the basis of their membership in a particular racial or ethnic group, typically one that is a minority or marginalized. [Oxford Languages]

Rural: Communities in Alaska outside of the larger cities of Anchorage, Fairbanks, and Juneau.

Science, Technology, Engineering, and Mathematics (STEM): STEM is a broad term used to group together these academic disciplines. This term is typically used to address an education policy or a curriculum choice in schools. [Wikipedia, Science, technology, engineering, and mathematics]

For the purposes of this workshop, there will be references to "STEM programs or opportunities" designed for undergraduates and/or youth. See the section below on Examples of Arctic STEM programs.

Subsistence: The harvest of fish and wildlife and plants that is important to a cultural way of life, especially for families in rural Alaska but also those that depend on subsistence hunting and fishing and gathering as a source of nutrition and cultural practices. This includes customary and traditional uses of harvesting naturally occurring fish and wildlife in a rural setting. Since 1989, all Alaska residents qualify for subsistence use practices and harvesting. [Alaska Department of Fish and Game Subsistence in Alaska: Home Page, Alaska Department of Fish and Game]

Undergraduate: a student at a college or university who has not yet earned a bachelor's or equivalent degree. [Oxford Dictionary]

Youth: Defined as the period between childhood and adult age. For this workshop, the age group or grade level focus is on upper high school (sophomore to senior; age 15+).

Common Acronyms for Organizations and Programs Working in the Arctic

ARCUS: Arctic Research Consortium of the United States is a U.S. 501(c)(3) not-for-profit corporation located in Fairbanks. ARCUS membership is open to organizations engaged in Arctic research, including academic, research, government, Indigenous, and corporations. Representatives of member organizations constitute the council of ARCUS and elect the board of directors. ARCUS is also enabled by individual supporters who see the value of ARCUS' work to connect and advance Arctic research. [https://www.arcus.org/arcus]

ANSEP: The Alaska Native Science and Engineering Program offers a wide variety of STEM opportunities for students from kindergarten through university. ANSEP's objective is to effect systemic change in the hiring patterns of Alaska Natives in science and engineering by placing students on a career path to leadership. ANSEP students can go from eighth grade to a bachelor's degree in five years or less with the Acceleration Academy program. [https://www.ansep.net]

IARPC: The Interagency Arctic Research Policy Committee brings together scientists from federal, state, academic, nongovernmental, industry, Indigenous, and international organizations to share their work and team up to solve hard problems, and is open to anyone who can contribute. [https://www.iarpccollaborations.org]

IARC: The International Arctic Research Center is at the University of Alaska Fairbanks campus and was founded in 1999. Its mission is to foster Arctic research in an international setting to help the nation and the world to understand, prepare for, and adapt to the pan-Arctic impacts of climate change. [https://uaf-iarc.org]

NIH: National Institutes of Health is a part of the U.S. Department of Health and Human Services, is the nation's medical research agency, consists of 27 different institutes and centers, and receives funding directly from the U.S. Congress. [https://www.nih.gov/about-nih/who-we-are/organization]

NOAA: National Oceanic and Atmospheric Administration is the agency of the U.S. government responsible for monitoring our climate and our environment and taking steps to preserve them. [https://www.noaa.gov/]

NSF: The National Science Foundation is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense . . ." NSF is vital because it supports basic research and people to create knowledge that transforms the future. [https://www.nsf.gov]

REU: The Research Experiences for Undergraduates program is funded and administered under the National Science Foundation. This program provides a funding source for undergraduate students in eligible universities and institutions. [https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517]

Examples of STEM Programs and/or Opportunities in Arctic Alaska

Alaska Area Health Education Centers (AHEC) Scholars Program: The Alaska Area Health Education Centers are academic and community-based partnerships engaged in primary care workforce engagement, training and recruiting, and retaining activities to improve the distribution, diversity, supply, and quality of health care personnel. The Alaska AHEC addresses its mission by working on (1) engaging Alaskans into health careers to evolve the future health workforce, (2) training health professions students in rural communities or with underserved populations via the AHEC Scholars Program, and (3) retaining Alaska's health workforce by increasing access to and providing continuing education/continuing medical education (CE/CME) opportunities statewide. [https://www.uaa.alaska.edu/academics/college-of-health/departments/ACRHHW]

Alaska IDEA Network of Biomedical Research Excellence (Alaska INBRE, Undergraduate Research Assistantship [URA]): The goal of the Undergraduate Research Assistantship is to develop undergraduate student skills in understanding biomedical and health research, applying critical abilities to conduct research, identifying problems in research, and proposing solutions to resolve problems. One of the aims of INBRE is to diversify the pipeline of students seeking careers in biomedical research and health in Alaska. [https://alaskainbre.org/opportunities/undergraduate-research-assistantship-uaa]

Alaska Native Science and Engineering Program (ANSEP): ANSEP's objective is to effect systemic change in the hiring patterns of Alaska Natives in science and engineering by placing our students on a career path to leadership. ANSEP students can go from finishing eighth grade to a bachelor's degree in five years with Acceleration Academy. They offer programs from kindergarten through graduate, summer and school year, and in statewide locations. [https://www.ansep.net]

American Indian/Alaska Natives Special Emphasis Program: The American Indian/Alaska Native Special Emphasis Program exists to promote equal opportunity in all aspects of employment (e.g., hiring, promotions, awards, performance appraisals, leadership development, as well as other training opportunities) and to promote actions to address barriers to full participation and inclusion. [https://www.nasa.gov/offices/odeo/special-emphasis-programs-AIAN/]

Arctic LTER REU: This is an example of an REU summer opportunity: "Ecosystems Center of the Marine Biological Laboratory is seeking applicants for Research Experience for Undergraduate (REU) positions. REU positions are available to U.S. citizens or Permanent Residents only who are currently enrolled as undergraduates at U.S. colleges or universities (no graduating seniors). Successful candidates will participate in field research on either terrestrial or aquatic ecosystems in the Toolik Lake Research Natural Area on the North Slope of Alaska. In addition to gaining experience by assisting on a variety of project activities, REU students typically engage in a small independent project that is linked to larger studies of lakes, streams, tundra or land-water interactions. REU participants are expected to collect and analyze data and to produce a poster describing their project near the end of the field season." [https://lternet.edu/opportunities/research-experience-for-undergraduates-reu-arctic-lter-2/]

Biomedical Learning and Student Training at UAF (BLaST): BLaST is a National Institutes of Health grant-funded undergraduate research program focused on STEM education and training at the University of Alaska Fairbanks campus. It was started in 2014 and is in its second five-year cycle. Their partners include all rural campuses of UAF, UAS, Alaska Pacific University, Ilisaġvik College, Diné College, Fort Lewis College, and Salish Kootenai College. [https://uaf.edu/academics/programs/blast.php]

GeoFORCE: GeoFORCE Alaska is an outreach program at the University of Alaska Fairbanks for rural high-school students from the North Slope, Northwest Arctic, and Interior. Students are recruited in eighth or ninth grade and travel around Alaska and throughout the country to learn about geology and career paths in geosciences. GeoFORCE Alaska is a four-year program. Each summer, the cohort of students reunites to attend a two-week academy in a different region of the U.S. Over four years, students will practice field geology at destinations including Denali National Park, the Grand Canyon, Crater Lake, Dinosaur National Monument, and Yellowstone. The four-year model of our program is designed to spark interest in the geosciences at a young age and maintain that interest throughout high school and into college. [https://geoforce.alaska.edu/]

IARPC Arctic STEM Education Working Group: This team includes federal and non-federal membership or invited guests. Through broadly inclusive meetings on a bimonthly to quarterly basis, this team plans to build understanding of the landscape of activities that exist and find opportunities for collaboration. The team's main

activity will be to host webinars from various Arctic STEM education organizations, programs, and projects to enhance awareness across the community. [https://www.iarpccollaborations.org/teams/Arctic-STEM-Education-Working-Group]

NOAA Fisheries' Partnership for Education Program (PEP) AK: This is an example of a past program that was featured in an online story. The goal of the program is to build a more diverse, inclusive, and effective marine resource workforce in Alaska. PEP AK is modeled after a similar program in Woods Hole, Massachusetts. It provides education in academic and Indigenous knowledge, as well as hands-on experience for undergraduate students entering marine-related professions. [https://www.fisheries.noaa.gov/feature-story/building-diverse-workforce-meet-challenges-alaskas-changing-marine-environment]

One Health and the Center for One Health Research: One Health is a holistic approach that recognizes the interdependence of human, animal, and environmental health and that the well-being of all will lead to improved health outcomes and enhanced resilience. The mission of the Center for One Health Research at the University of Alaska Fairbanks is to improve our research capacity and more effectively promote well-being in the North; build teams to create research, education, and outreach programs around One Health; and create long-term funding opportunities through collaboration. [https://www.uaf.edu/onehealth/]

Rural Alaska Community Action Program (RurAL CAP): A private, statewide, nonprofit organization working to improve the quality of life for low-income Alaskans. [https://ruralcap.com]

Rural Alaska Honors Institute (RAHI): This is a competitive summer bridge program that gives rural and Alaska Native students a chance to find out what it is like to be a college student. For six action-packed weeks, students live in dorms on UAF's Troth Yeddha' campus, take eight to eleven college credits, explore interior Alaska through a variety of outdoor activities, and volunteer in the Fairbanks community. The best part, aside from getting college credits and gaining lifelong friends from across the state, is that the entire experience is completely free. [https://www.uaf.edu/rahi/about.php]

Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS): This is an inclusive organization dedicated to fostering the success of Chicanos/Hispanics and Native Americans, from college students to professionals, in attaining advanced degrees, careers, and positions of leadership in STEM. [https://www.sacnas.org/]

UAF Alaska Space Grant Program: The Alaska Space Grant Program (ASGP) is a consortium of public and private universities and nonprofit organizations that sponsors a broad range of programs to enhance teaching, research, and educational outreach within aerospace and earth science and other NASA-related STEM disciplines throughout Alaska. [https://spacegrant.alaska.edu]

Robert Noyce STEM Teacher Scholarship Program: The program provides funding to institutions of higher education to provide scholarships, stipends, and programmatic support to recruit and prepare STEM majors and professionals to become K–12 teachers. [https://www.nsfnoyce.org]

Appendix 4. Workshop Agendas

Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

Workshop Agenda

Tuesday, April 13, 2021

Time (AKDT)	Agenda Activity and Presenter(s)
9:45 a.m.–10:00 a.m.	**Settle In** • The meeting room is open to all participants.
10:00 a.m.–10:20 a.m.	**Welcome!** • Blessing, *Elizabeth Fleagle, Elder* • Land Acknowledgment, *Amy Topkok, Steering Committee* • Introductions to Organizers, *Mike Castellini, Steering Committee*
10:20 a.m.–10:30 a.m.	**Workshop Philosophy and Goals** *Janet Warburton, ARCUS; Kaja Brix, NOAA; Lisa Rom, NSF*
10:30 a.m.–10:40 a.m.	**Workshop Agenda Overview** *Judy Fahnestock, ARCUS*
10:40 a.m.–10:45 a.m.	**Using Zoom** *Kuba Grzeda, ARCUS*
10:45 a.m.–11:00 a.m.	**Workshop Code of Conduct and Ground Rules** *Amy Topkok, Steering Committee; Alli Harvey, Facilitator*
11:00 a.m.–11:15 a.m.	**Setting the Stage** *Janet Warburton, ARCUS; Amy Topkok, Steering Committee* • An Overview of the 2020 Listen and Learn Sessions • Reviewing Glossary of Terms and Acronyms for Shared Understanding • Sharing the workshop objectives: ▪ What can be done to increase undergraduate and youth participation in existing Arctic STEM programs? ▪ What can programs do differently or how can programs adapt to support student engagement?
11:15 a.m.–11:20 a.m.	**Introduction to the Small Group Session #1** *Alli Harvey, Facilitator*

Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

Workshop Agenda

Tuesday, April 13, 2021

Time (AKDT)	Agenda Activity and Presenter(s)
11:20 a.m.–11:55 a.m.	**Session #1** Discussion focused on outreach and recruitment: • Introductions and getting to know you • Prompt 1: How can interested undergraduates and youth learn about Arctic STEM programming? • Key discussion takeaways Note: Each participant will be assigned to a breakout room. Every room will discuss the same topic and be assigned a facilitator and note taker. Each facilitator will report highlights or recommendations back to the main group.
11:55 a.m.–12:00 p.m.	**What's Next After the Break** *Judy Fahnestock, ARCUS*
12:00 p.m.–12:30 p.m.	**BREAK** (please stay logged into main Zoom room)
12:30 p.m.–12:50 p.m.	**Sharing Discussion Highlights and Recommendations** *Alli Harvey, Facilitator* • The facilitator from each breakout room from the morning will report back to the main group. • The main highlights and/or recommendations will be captured in main room.
12:50 p.m.–12:55 p.m.	**Introduction to the Small Group Session #2** *Alli Harvey, Facilitator*
12:55 p.m.–1:40 p.m.	**Session #2** Discussions focusing on relevancy, accessibility, and community engagement: • Introductions and getting to know you • Prompt 1: What are some ways to ensure Arctic STEM programming and projects are relevant to place and community interests and/or needs? • Prompt 2: What are ways in which Arctic STEM programming and projects can be more accessible? • Prompt 3: What are respectful, honest, and consistent ways to engage with communities? • Key discussion takeaways Note: Each participant will be assigned to a breakout room. Every room will discuss the same topic and be assigned a facilitator and note taker. Each facilitator will report highlights or recommendations back to the main group.
1:40 p.m.–1:55 p.m.	**Sharing Discussion Highlights and Recommendations** *Alli Harvey, Facilitator*
1:55 p.m.–2:00 p.m.	**Closing and Adjourn for the Day**

Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

Workshop Agenda

Wednesday, April 14, 2021

Time (AKDT)	Agenda Activity and Presenter(s)
9:45 a.m.–10:00 a.m.	**Settle In** • The meeting room is open to all participants.
10:00 a.m.–10:15 a.m.	**Welcome!** • Opening Remarks, *Mike Castellini, Steering Committee* • Land Acknowledgment, *Amy Topkok, Steering Committee* • Workshop Code of Conduct and Rules of Respect, *Amy Topkok, Steering Committee* • Plan of the Day, *Mike Castellini, Steering Committee*
10:15 a.m.–10:20 a.m.	**What Happened in Day 1?** *Alli Harvey, Facilitator*
10:20 a.m.–10:30 a.m.	**Setting the Stage** • Review Outcomes of 2020 Listen and Learn Sessions, *Janet Warburton, ARCUS*
10:30 a.m.–10:35 a.m.	**Introduction to the Small Group Session #3** *Alli Harvey, Facilitator*
10:35 a.m.–11:35 a.m.	**Session #3** Discussions focusing on partnerships and mentoring: • Introductions and getting to know you • What are some steps and best practices to establish effective partnerships on Arctic STEM programs and projects? • How can mentorship opportunities support undergraduates and youth students? • What does effective mentoring look like? • Key discussion takeaways Note: Each participant will be assigned to a breakout room. Every room will discuss the same topic and be assigned a facilitator and note taker. Each facilitator will report highlights or recommendations back to the main group.
11:35 a.m.–11:55 a.m.	**Sharing Discussion Highlights and Recommendations** *Alli Harvey, Facilitator* • The facilitator from each breakout room will report back to the main group. • The main highlights and/or recommendations will be captured in main room.
11:55 a.m.–12:00 p.m.	**What's Next After the Break** *Judy Fahnestock, ARCUS*
12:00 p.m.–12:30 p.m.	**BREAK** (please stay logged into main Zoom room)
12:30 p.m.–12:35 p.m.	**Introduction to the Small Group Session #4** *Alli Harvey, Facilitator*

Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

Workshop Agenda

Wednesday, April 14, 2021

Time (AKDT)	Agenda Activity and Presenter(s)
12:35 p.m.–1:40 p.m.	**Session #4** Discussions focusing on funding and long–term support: • Introductions and getting to know you • How does funding (what, who, and how efforts are funded) impact the effectiveness of Arctic STEM programming designed for rural and Alaska Native undergraduates and youth? • What practices should be in place to ensure undergraduates and youth are supported both before and after Arctic STEM programming/projects? • Key discussion takeaways Note: Each participant will be assigned to a breakout room. Every room will discuss the same topic and be assigned a facilitator and note taker. Each facilitator will report highlights or recommendations back to the main group.
1:40 p.m.–1:55 p.m.	**Sharing Discussion Highlights and Recommendations** *Alli Harvey, Facilitator* • The facilitator from each breakout room will report back to the main group. • The main highlights and/or recommendations will be captured in main room.
1:55 p.m.–2:00 p.m.	**Closing and Adjourn for the Day**

Engaging Rural and Alaska Native Undergraduates and Youth in Arctic STEM

Workshop Agenda

Thursday, April 15, 2021

Time (AKDT)	Agenda Activity and Presenter(s)
9:45 a.m.–10:00 a.m.	**Settle In** • The meeting room is open to all participants.
10:00 a.m.–10:15 a.m.	**Welcome!** • Opening Remarks, *Mike Castellini, Steering Committee* • Land Acknowledgment, *Amy Topkok, Steering Committee* • Workshop Code of Conduct and Rules of Respect, *Amy Topkok, Steering Committee* • Plan of the Day, *Mike Castellini, Steering Committee*
10:15 a.m.–10:45 a.m.	**Bringing It All Together** *Alli Harvey, Facilitator* • Review of day one and day two • What we've learned so far • Relationship to the workshop objectives
10:45 a.m.–10:50 a.m.	**Introduction to the Small Group Session #5** *Alli Harvey, Facilitator*
10:50 a.m.–11:55 a.m.	**Session #5: Review, Refine, Recommend** Discussions on recommendations and how the recommendations address the larger questions on: What can be done to increase undergraduate and youth participation in existing Arctic STEM programs? • What can programs do differently or how can programs adapt to support student engagement? • Key discussion takeaways Note: Each participant will be assigned to a breakout room. Every room will discuss the same topic and be assigned a facilitator and note taker. Each facilitator will report highlights or recommendations back to the main group.
11:55 a.m.–12:00 p.m.	**What's Next After the Break** *Judy Fahnestock, ARCUS*
12:00 p.m.–12:30 p.m.	**BREAK**
12:30 p.m.–1:00 p.m.	**Sharing Discussion Highlights and Recommendations** *Alli Harvey, Facilitator* • The facilitator from each breakout room from the morning will report back to the main group. • The main highlights and/or recommendations will be captured in main room.
1:00 p.m.–1:30 p.m.	**Next Steps and Reflections** *Alli Harvey, Facilitator*
1:30 p.m.–1:50 p.m.	**Products, Community Feedback, and Sharing Process** *Alli Harvey, Facilitator; Janet Warburton, ARCUS*
1:50 p.m.–2:00 p.m.	**Closing and Workshop Adjourns**

Appendix 5. Participant List (alphabetical by last name)

Vladimir Alexeev, International Arctic Research Center, University of Alaska Fairbanks
Sharon Alstrom, Yukon Delta Fisheries Development Association
Christopher Baird, Battelle/NEON
Maureen Biermann, International Arctic Research Center, University of Alaska Fairbanks
Kaja Brix, NOAA Fisheries/University of Alaska Fairbanks
Christi Buffington, International Arctic Research Center, University of Alaska Fairbanks
Michael Castellini, retired, University of Alaska Fairbanks
Douglas Causey, University of Alaska Anchorage
Malinda J. Chase, University of Alaska Fairbanks
Thomas Chen, Academy for Mathematics, Science, and Engineering
Richard Collins, University of Alaska Fairbanks
Sarah Crowley, self
Luis Cubano, U.S. National Institutes of Health
Haley Dunleavy, Northern Arizona University
Hajo Eicken, International Arctic Research Center, University of Alaska Fairbanks
Kaare Sikuaq Erickson, Ukpeaġvik Iñupiat Corporation (UIC) Science
Eric Filardi, Anderson School
Gilberto Fochesatto, University of Alaska Fairbanks
Adrian Gall, ABR, Inc.—Environmental Research and Services
Lori Gildehaus, University of Alaska Fairbanks
Anne Gold, University of Colorado Boulder
Rachael Hannah, University of Alaska Anchorage
Alli Harvey, Information Insights
Adelheid Herrmann, Alaska Center for Climate Assessment and Policy
Diane Hirshberg, University of Alaska Anchorage/UArctic
Lisa Hiruki-Raring, NOAA Fisheries
Shariah Hunt, Alaska Native Science and Engineering Program
Claudia Ihl, Northwest Campus, University of Alaska Fairbanks
Dave Jones, University of Montana
Gregory Kahoe, University of Alaska Fairbanks
Kayde Kaiser Whiteside, Alaska Space Grant Program, University of Alaska Fairbanks
Marlene Kaplan, U.S. National Oceanic and Atmospheric Administration
Michael Koskey, University of Alaska Fairbanks

Vera Kuklina, George Washington University
Erin Larson, Alaska Pacific University
Olga Lauter, École des hautes études en sciences sociales (EHESS)
Olivia Lee, University of Alaska Fairbanks
Chris Maio, University of Alaska Fairbanks
Michael Martinez, University of Alaska Anchorage
Sarah Messenger, Marine Biological Laboratory
Sue Natali, Woodwell Climate Research Center
Mohamed Niagne, Alaska Native Science and Engineering Program
Linda Nicholas-Figueroa, Iḷisaġvik College
Nafeesa Owens, U.S. National Science Foundation
Veronica Padula, Aleut Community of St. Paul Island Tribal Government
John Pearce, USGS Alaska Science Center
Darcy Peter, Woodwell Climate Research Center
Kimberly Pikok, University of Alaska Fairbanks
Natalia Podlutskaya, University of Alaska Fairbanks
Michelle Quillin, University of Alaska Fairbanks
Elizabeth Rom, U.S. National Science Foundation
Margaret Rudolf, Alaska Center for Climate Assessment and Policy
Katherine Schexneider, self
Todd Sformo, North Slope Borough Department of Wildlife Management
Olga Skinner, University of Alaska Fairbanks
Brendan Smith, North Pacific Research Board
Catherine Sopow, U.S. National Weather Service, Alaska Region
Beth Spangler, Alaska Native Science and Engineering Program
Elena Sparrow, International Arctic Research Center, University of Alaska Fairbanks
Sorina Seeley, U.S. Interagency Arctic Research Policy Committee
Sara Thomas, self
Denise Thorsen, Alaska Space Grant Program, University of Alaska Fairbanks
Amelia (Amy) Topkok, University of Alaska Fairbanks
Liz Weinberg, U.S. Interagency Arctic Research Policy Committee
Courtney Weiss, Yukon Delta Fisheries Development Association
Alexis Will, University of Alaska Fairbanks
Ming Xiao, Pennsylvania State University
Amanda Young, University of Alaska Fairbanks

ARCUS Staff

Judy Fahnestock, Project Coordinator
Kuba Grzeda, Project Manager
Lisa Sheffield-Guy, Project Manager
Janet Warburton, Project Manager
Helen Wiggins, Executive Director