Polar STEAM: An Emerging National Science Foundation Education and Outreach Initiative

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**Information Paper submitted by the United States**

***Summary***

Polar STEAM is an educational project that combines the principles of STEAM education (Science, Technology, Engineering, Art, and Math) with the study of polar regions and the science conducted there which encompasses a wide range of disciplines, such as ocean and atmospheric science to economics, anthropology, glaciology, organisms and ecosystems, and glaciology. It combines and expands previous programs, including the Antarctic Artists and Writers (AAW) program and various Polar Educators programs. In 2022, Oregon State University (OSU) was awarded a Cooperative Agreement to manage Polar STEAM. The goal of the new project is to offer both in-person and virtual experiences, open participation to faculty from Minority Serving Institutions, foster collaborations between artists, writers, educators, and researchers, and make the programs more diverse, equitable and inclusive. The first collaborations will be virtual and mainly focused on the Arctic, but the program leaders expect that field deployments to the Arctic and Antarctic will resume in 2024.

***Background***

[Polar STEAM](https://polarsteam.info/) is a new project that is supported by a collaboration between the U.S. National Science Foundation’s Office of Polar Programs (OPP) and its Directorate for STEM Education. It encompasses and builds off two longstanding NSF efforts to support an AAW program and a program to engage informal and formal educators in polar sciences with the aim to increase the public’s understanding and appreciation of the Polar regions.

Between 1950 and 2020, NSF funded AAW to help U.S. citizens better understand the work being conducted in Antarctica. Participating artists and writers deployed to Antarctica and collaborated with polar researchers to work on projects that focused on interpreting and representing the scientific activities being conducted in the Antarctic region. AAW has supported a broad range of work, including novels, books for children, digital media, film, graphic art, history, history of science, humanities scholarship, illustration, literature, musical composition, painting, photography, poetry, and science fiction. The online exhibition, [Adequate Earth](https://www.aawcollective.com/adequate-earth-exhibition), produced by participants of AAW is an example of one of the collaborations achieved through the program. The previous AAW was managed directly by NSF, and the [NSF website](https://www.nsf.gov/geo/opp/aawr.jsp) provides a complete list of all past AAW participants.

The most recent Polar Educators program, also known as PolarTREC (Teachers and Researchers Exploring and Collaborating), was established in 2007 and provided elementary and secondary-school teachers the opportunity to travel to Antarctica to improve their ability to teach STEM subjects. PolarTREC was funded through awards from the National Science Foundation and administered by the Arctic Research Consortium of the United States (ARCUS). During its operation, teachers and informal educators participated in PolarTREC to collaborate in Arctic and Antarctic field settings with polar researchers and to bring their experiences back to classrooms and museums to inspire the next generation of scientists and researchers.

The STEAM (Science, Technology, Engineering, Art, and Math) movement gained momentum in the early 2010s as educators and policy makers recognized the value of incorporating creative and artistic thinking into STEM (Science, Technology, Engineering, and Math) education. The concept is to connect to a broader group of learners by combining the importance of creativity and curiosity along with academic engagement and critical thinking. Incorporating art into STEM learning experiences allows students of all ages to access science concepts from different vantage points which in turn enhances creative thinking, engagement, and understanding.

To broaden access to polar research experiences and to integrate the AAW and the Polar Educators programs, NSF awarded an interdisciplinary team at OSU a Cooperative Agreement to run the project, Polar STEAM in September 2022. The collaboration includes a partnership of several OSU entities including: the STEM Research Center, the Patricia Valian Reser Center for the Creative Arts, Pre College Programs, the Colleges of Earth, Ocean, and Atmospheric Sciences and the College of Liberal Arts. OSU and its partners will facilitate virtual collaborations and field deployments annually beginning in 2023. The 2023 deployments will be virtual and will focus on the Arctic. The first anticipated Antarctic season will be in 2024/2025.

***Polar STEAM Goals***

OSU is managing the components of Polar STEAM, including the AAW and Polar Educator programs, as parallel but synergistic programs while also expanding their reach and promoting diversity, equity, and inclusion by allowing a broader range of educators and students to participate. As the facilitator of Polar STEAM, OSU has five goals:

1. Expand the reach of the Polar Educator’s program by including middle and high school science educators, informal educators, and faculty from community colleges and Minority Serving Institutions;
2. Initiate institutional management of the AAW program;
3. Make participation more accessible by providing virtual collaboration options;
4. Integrate both the AAW and the Polar Educators Program while also fostering collaboration between all participants (artists, writers, and educators); and
5. Broaden the public impact of Polar STEAM

Polar STEAM will provide a unique opportunity that benefits not only the individual artists, writers, and educators but also the diverse communities that they serve. NSF-funded researchers will also have an opportunity to enhance the Broader Impact of their work. Researchers across a wide spectrum of disciplines working in both in the field and conducting polar research remotely will have the opportunity to collaborate with artists, writers, and educators. Participants that are selected will be designated as “Polar STEAM Fellows”, and they will work together in a collaborative environment where the educators, scientist and artists are all equal participants. Creating a space where these collaborations are cultivated will allow the Polar STEAM Fellows to work together on interdisciplinary projects and produce new insights and perspectives. Professional development curriculum will also be integrated into the Polar STEAM program for all participants and funding will be available for educators who successfully complete the program to attend conferences to present their work. Polar STEAM will promote broader public understanding of polar sciences, and seeks to develop long-term relationships between educators, scientists, artists, and writers. Prospective applicants can stay up to date by joining the Polar STEAM [newsletter](https://polarsteam.info/email-signup/).

***Virtual Collaborations***

In an effort to make collaborations more accessible, Polar STEAM has created a virtual participation option. Individual educators will be partnered with researchers and all collaborators and interactions will take place virtually. Polar STEAM will facilitate initial virtual meetings between participants and researchers to collaboratively develop a new STEAM-focused educational resource. Virtual collaborations serve to decrease barriers and increase access to polar research projects. Although the exact mechanisms are still being developed, educators who have previously been unable to deploy for multi-week field seasons can now apply to participate as a virtual collaborator during their school year. Each virtual collaboration will be unique, and the time commitment and project outcome will depend on the nature of the collaboration between the researcher and educator. Virtual collaborations are anticipated to begin as early as May 2023 and will be completed within nine months.

***Field Collaborations***

The AAW program will send participants to the Antarctic who are creative professionals within the arts and humanities, whereas the Polar Educators program will facilitate both virtual and field deployments to the Arctic and Antarctic for both informal and formal educators working in the United States. Field locations may vary as some participants may stay in remote field locations that have harsh environmental conditions, while others may live in a dormitory setting.   
Participants will be able to indicate their comfort level for a potential field deployment. The length of the deployments will be dependent on various factors; however, the typical deployment will range between two and six weeks. Arctic deployments will generally be between May and September, and Antarctic deployments will be between October and February.

***Conclusions***

While Polar STEAM is still in the development stage and logistical constraints and programming are in progress, its initiative creates new opportunities to connect the perspectives and work of creatives, educators, and researchers in some of the most interesting, vulnerable, and critical ecosystems on the planet. Virtual and field opportunities will be available to educators, artists, and writers, so they can personally experience the impacts of these important polar science programs and, in turn, communicate the meaningful scientific work to a broader public audience.