



Teach the Teacher! Building ROVs to Teach Polar Science

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Overview

PolarTREC (*Teachers and Researchers Exploring and Collaborating*) is a National Science Foundation funded, multi-year program in which K-12 teachers participate in polar research, working closely with scientists, as a pathway to improving science education through teachers' experiences in scientific inquiry.



More information can be found at www.polartrec.com

The *Polar ROV Workshop* was organized by the Arctic Research Consortium of the United States (ARCUS) to provide STEM engineering and polar science training for teachers alongside scientists and teacher mentors. Funding for the workshop was provided by the US Antarctic Support Contract - Lockheed Martin.

Participating teachers increased their knowledge and understanding of polar research and the use of ROVs (remotely operated vehicles) in conducting studies in the polar regions. All teacher teams went on to successfully design, build, and troubleshoot an ROV equipped with water sampling capabilities and shared the challenges and successes along with the support and encouragement from teacher leaders. PolarTREC teacher mentors were able to utilize their PolarTREC experience to increase the impact of the workshop on the new participants.

Workshop Goals

- Increase the teachers' content knowledge about the Polar Regions, specifically related to how to teach polar science to their students
- Improve the knowledge and skills related to best practices for K-12 science education for both teacher and scientist participants
- Increase collaborations between teachers and scientists by fostering new relationships and by mentoring teachers not familiar with Polar Regions
- Engage participants in hands-on activities and increase their knowledge of Polar Regions
- Increase the contributions of scientists to the broader impacts of their research
- Complete a portfolio of STEM related lessons and/or products that can be utilized by classrooms nationwide (e.g. robotics built by students and get tested by polar researchers; post-workshop webinar to share with other teachers, etc.)

Teachers and research teams together



transform careers and classrooms.

3 Day **ROV** Workshop



UNDERWATER
remotely operated vehicle



Content Analysis from open-ended interview responses and participant surveys resulted in the common themes of:

- Quality of collaboration and networking
- Effectiveness of hands-on activities to support the design, building, and trouble-shooting of the ROVs
- Value of professional gains that resulted from the workshop experiences
- Confidence and ability to move forward with classroom implementation of polar science lessons and building ROVs with students



100% have plans to take what they learned back to their schools and implement an ROV project with their students.

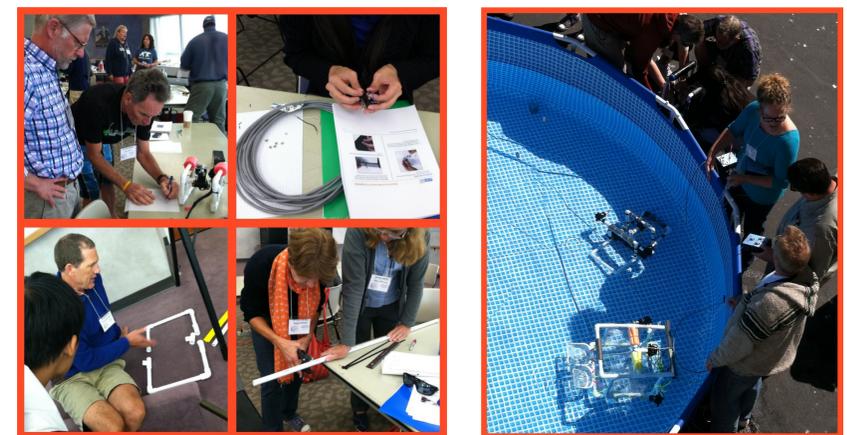
Evaluation and New Research Question

Recent studies cite five distinct characteristics of effective professional development, listed in the table below (Desimone, 2009). ARCUS' *Polar ROV Workshop* evaluation concludes that all characteristics are addressed in this project.

Characteristics of Effective Professional Development	Workshop Highlights Reported in Evaluation
Focus on specific content	<ul style="list-style-type: none"> • Opportunities to learn about: <ul style="list-style-type: none"> • science, exploration, and research from polar researchers. • polar research currently taking place and how ROVs are being used in real world situations.
Engage in active learning	<ul style="list-style-type: none"> • An opportunity to design and build an ROV.
Enable collective participation	<ul style="list-style-type: none"> • Working with the PolarTREC teacher mentors and other experts. • Networking and collaboration with scientists.
Coherence with policy & practice	<ul style="list-style-type: none"> • Learning how to apply the project with students in the classroom.
Sufficient Duration	<ul style="list-style-type: none"> • Learning and action time was well-balanced. • Time was efficiently used and well spent.

ARCUS contends that the addition of a teacher-leaders in a mentorship position increases workshop effectiveness in transference of science concepts and practices to the classroom for the purpose of STEM education reform.

PolarTREC participants increase their science content knowledge and self-efficacy in teaching. These two factors, paired with the motivation to change practices (pedagogical discontentment) are necessary for systemic education reform (Enderle, et. al. 2014). Programs and workshops, facilitated by ARCUS appeal to educators ready for change. PolarTREC teacher-leaders provide a sustainable support network for the intense development participants experience while in-program, as well as support when making changes in teaching practices back in the classroom.



Citations
Enderle, P. et al. (2014) *Examining the Influence of RETs on Science Teacher Beliefs and Practice*. Science Education. Vol 98(6), 22-23.
Desimone, L. (2009) *Improving impact studies of teachers' professional development: Towards better conceptualizations and measures*. Educational Researcher. 38(3), 181-199.