On board with MOSAiC: How a real Arctic research expedition can engage students in the true nature of science

Connect your classroom to historic Arctic expeditions of the past (**Fram**) and present (**MOSAiC**) with a new curriculum developed by the education and outreach team at the University of Colorado Boulder.

About this Course

Why would hundreds of scientists from around the world intentionally freeze a ship in Arctic sea ice for an entire year, braving subzero temperatures and months of polar darkness? This may sound like a fictional adventure movie plot, but from September 2019 through October 2020, the MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) Arctic research expedition did just this. Inspired by the 1893 Fram expedition, the MOSAiC expedition aims to better understand the changing Arctic climate system by freezing a ship in ice and drifting with the ice across the Arctic -- studying ocean, atmosphere, and sea ice processes.

Bring the MOSAiC expedition and the true nature of science into your classrooms with a new curriculum developed by the education and outreach team at the University of Colorado Boulder. In this course, you'll hear from MOSAiC scientists and the curriculum developers as they lead you through "**Exploring the New and Old Arctic**", a curriculum tied to NGSS nature of science standards in which students compare and contrast past (Fram) and present (MOSAiC) Arctic expeditions to prepare for the Arctic of the future. Engage with 360 virtual expeditions, authentic real-time Arctic datasets, and App-based labs in this 2-day online teacher workshop.

Photo Credit: Esther Horvath/AWI

Course Goal

The goal of this course is to introduce educators to NGSS nature of science standards in the context of the MOSAiC-related curriculum, "**Exploring the New and Old Arctic**". At the end of the course, you will be able to effectively facilitate each lesson, connecting concepts and standards back to the unit driving question, "How have scientific questions, methods, technologies, and our knowledge of the Arctic changed over the past 125 years?"

Your Instructors

Jonathan Griffith, Education & Outreach Associate, Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado Boulder

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Course Format

This interactive workshop will be conducted virtually via Zoom. Facilitators will lead participants through each lesson of the curriculum following the approach below:

1) Utilize the main Zoom meeting room for lesson instructions
2) Participants engage with lesson resources either individually or in small groups via Zoom breakout rooms
3) Everyone returns to the main Zoom room to wrap-up and reflect on the lesson

Suggested Readings

There are no required readings for this course. However, we recommend reviewing the unit summary and curricular resources prior to the start of the course.
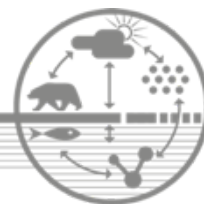
Course Content

Day 1: Tuesday, July 28th from *10 am – 2 pm MT*

Activity/Resource	How will you be engaging with the activity/resource?
Welcome and Introductions	● Who are you and why are you excited about the Arctic?
Nature of Science in Today's Classrooms	● Reflect on how participants teach the process of science in their classrooms. ● Introduce NGSS nature of science standards
Course Overview	● Discuss the flow and content of the curriculum
Lesson 1: Introduction to the Arctic	● Discuss the Arctic of the future ● Introduce anchoring phenomenon
Lesson 2: Fram Motivation	● Engage with the Fram expedition by touring the historic ship, *Fram*, via virtual reality Google Expeditions
Lesson 3: MOSAiC Motivation	● Construct a line graph from Arctic sea ice extent data (1979-2019) ● Develop public record to include factors that contribute to the growth and melt of sea ice (e.g., increasing temperatures) ● Compare and contrast observed vs. modelled changes in sea ice extent
Lesson 4: Ice Floe Identification	● Analyze and interpret data of Arctic ice thickness, ocean drift paths, and satellite imagery to identify "suitable" ice floes with which to attach a research vessel to
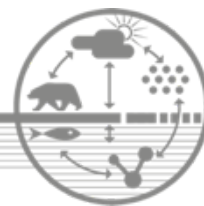
Day 2: Wednesday, July 29th from *10 am – 2 pm MT*

Resource/Activity	Workshop Engagement: What will you be doing?
Lesson 4: Ice Floe Identification	● Analyze and interpret data of Arctic ice thickness, ocean drift paths, and satellite imagery to identify "suitable" ice floes with which to attach a research vessel to
MOSAiC Scientists Presenter	● Atmospheric scientist, Dr. John Cassano
Lesson 5: Measuring Albedo	● Utilize the "Albedo: A Reflectance App" to measure the albedo of different colored surfaces
Optional Extension: Ice-Albedo Feedback	● Calculate the albedo from imagined maps of the Arctic representing two scenarios, 1) lots of ice, and 2) reduced ice cover
Final Assessment(s)	● Construct a final descriptive model and explanation for the anchoring phenomenon *(Must be submitted to the course instructors)*
Additional MOSAiC-related Resources	● Explore the **mosaic.colorado.edu/education** web page for MOSAiC education resources
Feedback Survey and Closing Remarks	● Complete an online feedback survey about the course

FInal Assignments *(required)*:

As part of the course, participants are required to complete a final assignment outside of online course hours. Participants will reflect on their learning from the course to construct a final visual representation for the unit driving question, "How have scientific questions, methods, technologies, and our knowledge of the Arctic changed over the past 125 years?" Upon completion, please scan and submit your final assignment documents to jonathan.griffith@colorado.edu. *Note: This is the same summative assessments your students would complete at the conclusion of the unit.*