

Classroom Implementation Strategy

Due Date(s):

Due Before Departing for the Expedition

Review After Returning from the Expedition

Purpose:

The Classroom Implementation Strategy is the heart of your Education and Outreach Plan, as it represents how you will share your research experience with your students.

Process:

You will begin by establishing learning goals for students that are linked to National and your State Performance Standards for Mathematics, Science or Technology. Choose a concept or major idea in a subject area upon which to focus. This will be followed by inquiry-based activities established to meet learning goals. The final phase of the Implementation Strategy describes the way in which students will be assessed after the implementation.

Use the questions below and the Classroom Implementation Strategy Template to guide your Implementation Strategy. If you would like, you may use a different method to organize the information - the template below is just one possible example. The questions were developed using National Board for Professional Teaching Standard entries as a guide.

Big picture ideas to keep in mind as you develop the Strategy may include:

- What specific content in mathematics, science and/or technology do I want my students to acquire?
 - [Astrobiology](#)
- Will my students develop skills for investigating problems on their own and with others?
 - [Both on their own \(research\) and collaboratively \(debates\)](#)
- Will my students see the relationship between science and mathematics content they learn in school and problems they encounter in everyday life?
 - [Ethics: As we talk about the definition of life and our role as environmental stewards, students will be interested the prospect of colonizing other planets](#)
- How will students recognize how scientific and mathematical understanding is actually produced?
 - [Students will read real scientific articles and listen to stories from PolarTREC teachers to gain answers to their research questions](#)
- What science, technology, engineering, and math career opportunities exist in the polar regions?
 - [Physicists](#)
 - [Astrophysicists](#)
 - [Engineers](#)

- How will I promote scientific literacy among all students?
 - I will have students read sections from the books I have read and the journals I will read so they have a background understanding.
 - I will also have them read journals from previous PolarTREC teachers so they can understand some of the context of the research

Teaching/Learning Goals:

- What are your goals for student learning in connection to the major idea/concept featured in the Classroom Implementation Strategy? Link these goals to National and Local Standards, Needs Assessment and the Research Experience Reflection.
 - How can we define life?
 - How does life survive in hostile environments?
 - How can humans survive in hostile environments? (Mars, Antarctica, etc.)
 - What is it like to colonize other environments? (Mars, Antarctica, colonies, etc.)
- Why do you consider this major idea/concept to be important and appropriate for your students to learn about?
 - Introduction to biology – what is the definition of life
 - Set up the arc of the year in the class
- What challenges or misconceptions are inherent in teaching this idea/concept to students?
 - Students struggle to understand the 7 characteristics of life (they often think that breathing or moving indicates life)
- How is your instruction designed to meet these challenges?
 - Providing examples and allowing students to debate whether it should be considered abiotic or biotic

Classroom Activities:

- Using the 5-E Model (Engage, Explore, Explain, Extend, Evaluate) or another Inquiry model, describe activities students will be involved in as they engage in the concept/major idea.
 - 1. ENGAGE: show a video about tardigrades and what makes them so unique
 - 2. EXPLORE: using a consensus placemat, students decide on a definition of life
 - 3. EXPLAIN: show students the 7 characteristics of life
 - 4. EXTEND: allow students to research these characteristics and understand why they fit
 - 5. EVALUATE: Agree/disagree vote with feet to discuss and debate some of the examples and determine if they are alive or not (ex. A rock, algae, a mule, etc.)
- How will activities be sequenced and organized?
 - Inquiry first, research after questions are developed
- What type of resources/background information is needed to develop the concept? This may include content background, websites, etc.
 - NASA Resources
 - PolarTREC Resources
 - Humanities connection with colonialism

- What safety procedures need to be considered during the implementation of the activities?
 - N/A
- Include activities developed and a time line for implementation.
 - Day 1: characteristics of life development
 - Day 2: life in hostile environments on earth (Antarctic overview)
 - Day 3: potential for life in hostile environments on other planets (NASA connection)
 - Day 4: the right to colonize other planets: ethical discussion (planetary protection)

Evaluation:

- What criteria will be used to assess student learning during and following the implementation plan?
 - Can students successfully identify the 7 characteristics of life, identify a living organism, and provide examples of extremophiles?
- Include examples of assessment instruments. This could include rubrics, quizzes, tests, etc.,
 - Sample test questions:
 - Why is astrobiology an important subject for biologists to study?
 - What is an extremophile? Provide an example.
- How will you know if your goals have been accomplished? What will you do if your goals are not met?
 - Students can successfully explain the 7 characteristics of life and identify if something is living

Distribution:

Besides sharing this strategy with your team and PolarTREC, this is a great document to share with your school administration and peers. Consider sharing some or all of this with students and parents. Let them know how you plan on using this experience as a teacher.