

SEEC 2021 Additional Information (Lesson plan and materials)

Main Presenters: Angela Krause-Kuchta and Thomas Drummond

Title: Challenging Students Through Their Participation in Space-Based Research

Brief description (50 words or less): Learn how students can participate online in an ISS experiment, focusing on a biofilm experiment and on a materials science experiment

Objective: Our objective is to introduce teachers to a unique opportunity for their students to participate in data analysis of a space-based experiment and to provide teachers with the content knowledge to support student understanding of the experiment.

Relation to Space exploration: The experiment that we will introduce to teachers, “Space Biofilms,” which launched to the ISS National Lab in October 2019 (analysis has been delayed due to Covid.) The experiment demonstrates the critical role that microgravity can play in improving life on Earth.

Science Concepts Covered: Our session will cover biology, engineering and scientific experimentation (method)

Next Gen Standards:

HS-LS2-6.

HS-ETS1-1.

HS-ETS1-2

HS-ETS1-3.

MS-LS1-1

MS-LS1-5

MS-LS2-4.

MS-ETS1-3.

Developing & using models

Analyzing & interpreting data

Obtaining, evaluating, & communicating information

Systems & system models

Stability & change

Activity: Teachers will collect and observe oral biofilms in their own mouths. To do this, they will use dental disclosing tablets to show plaque on their teeth, then scrape this off and place on a slide to observe the biofilm under a microscope. Since some will not have access to a microscope, we will provide images of plaque under a microscope. They will then brush their teeth, using a variety of techniques to model how difficult it is to remove biofilms without manual extraction.

Materials:

Participants should have the following materials for our presentation:

1. 1-2 Dental disclosing tablets (We recommend asking their dentist for these.)
2. Toothbrush (This may get stained, so participants may want an inexpensive or older one.)
3. Toothpaste
4. Mouthwash (if available in the home already – not all participants will need this)

Optional:

5. Microscope slide and coverslip
6. Toothpick
7. Microscope

Methods: We will provide a power-point, interactive discussion of our program and the science behind a microgravity research experiment. We will introduce the science behind biofilms, including a video interview with the principal investigator of the Biofilms in Space mission. We will guide teachers through a modeling activity that they will be able to use in their classrooms.

Session Outline:

- I. Introductions of Orion's Quest staff, Luis Zea (researcher) and the Orion's Quest program, including an explanation of the role Orion's Quest plays in connecting teachers/students with NASA scientist and their research and other NASA affiliated entities such as ISSNL and BioServe Space Technologies (Boulder, CO) (10 min.)
- II. Background science information relating to the microgravity experiment (25 min.)
- III. Modeling activity (15 min.)
- IV. Demonstration of video analysis (10 min.)
- V. Introduction to the materials science experiment of Dr. Firouzeh Sabri of the University of Memphis (15 min)
- VI. How teachers can engage their students in authentic space-based research (5 min.)
- VII. Closing remarks and question/answer period (10 min.)

Session Outcome

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In our presentation, we will provide participants with an introduction of who we are and what we do with Orion's Quest, including a brief background of past missions and the importance of authentic research in the classroom. This will be followed by a lesson on the science behind a current biology research experiment, recently returned from the ISS. Participants will model the growth, collection, observation, and removal of oral biofilms, for use in their classrooms. They will then access sample images downlinked from ISS to demonstrate the work that students will do if their teacher chooses to participate in a free Orion's Quest mission. In addition, we will highlight the materials science experiment of Dr. Firouzeh Sabri (University of Memphis), anticipated to launch to ISS later this year. Participants will be able to bring back to their

classroom knowledge of why engaging their students in authentic research is important, how they can easily accomplish this task, scientific knowledge to demonstrate an out of this world solution to a devastating problem on Earth, and a model to help demonstrate this solution.