Lesson Plans

PRE-PRODUCTION		

a. **Phase 1 – Pre-Production**: This phase of the program is when students explore the science content, decide on the topic for their film, and do all the preparatory work before filming begins. Although students generally want to dive right in to filming, this phase is critical to producing a quality film and ensuring that the scientific basis for the film is sound. The following lesson plans are designed to provide scaffolding for students as they begin to think about these important background issues.

Pre-Production	Estimated Time	Worksheets
Lesson 1. Topic Selection	**1-2 hours**	Brainstorming
Lesson 2. Topic Research	**2-3 hours + possible outside time**	Research guide
Lesson 3. Script/Treatment Writing	**1 hour + possible outside time**	Treatment prompt
Lesson 4. Storyboarding	**2-3 hours**	Storyboarding

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Lesson 1. Topic Selection (1-2 hours)

Overview:

In this stage, students select their film's topic. The best topics are focused on local issues and impacts of climate change; for example, if your school is in a rural area, a good topic could explore water resources and agricultural use under future climate change. Film is a visual narrative medium, so pick topics that can be "seen," "viewed," or "experienced." It is helpful to show students example videos from previous student groups (see resources for sample videos) and other productions which can help with brainstorming ideas. Another benefit to locally-focused topics is that it will provide more interview subjects for the video (see resources for finding experts to interview). Going back to the example, students can interview scientists and local farmers and ranchers about their water. Finally, and most importantly, have the students discuss why they want to make a film about this topic and why it's important. Finally, students record a short (30 sec) vlog that describes their topic and why it's important.

Learning Objectives:

- Students will apply their knowledge of climate change science to a local problem.
- Students will discuss the importance of various local climate change issues.
- Students will understand the effects of a global issue on their community.

Materials: Brainstorm handouts, whiteboard

Procedure:

Students will use the brainstorming handout (Appendix) to begin to think about topics that interest them. Students can begin with either global change topics (e.g., sea level rise) or local issues that might be climate related (e.g., decrease in fish populations). For example, some students may know about the atmosphere and its composition, and other students might have hobbies, such as hunting or skiing. Initial brainstorming may be done either with the whole class or in small groups. Guiding questions can include, for example, whether students are aware of any local impacts of climate change or any local mitigation strategies (e.g., solar panels, lawn watering restrictions). The goal is to create a document that reflects the climate-topic interests of everyone in the group, whether or not those topics are all directly related.

After an initial brainstorm document is created, students can assess as a group which topics are of the broadest interest to the group, which topics may be examined visually (i.e., make an interesting visual story), and which topics are of most critical local importance.

Students should take time to examine the potential topics and discuss them thoroughly. Ensure that even students who are less enthusiastic about the topic still have a piece that they can contribute.

Once a broad topic has been chosen, be sure to take a picture or record in other ways the group brainstorm so that it can be referred back to in subsequent lessons.

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Lesson 2. Topic Research (2-3 hours + possible outside time)

Overview:

As students begin to develop their topics, they will need a foundation of climate science knowledge. As a short introduction or refresher, the teacher can connect prior knowledge with new information and introduce important scientific terms and vocabulary. The Climate Literacy Principles (USGCRP, 2009) provide a comprehensive overview of the basics of climate science. Guidance on teaching these basic concepts is provided by cleanet.org. Depending on the implementation context, showing a basic overview film about the Earth's energy balance or the role of greenhouse gases can provide a sufficient basis for the research (e.g., https://www.youtube.com/watch?v=MW3b8jSX7ec). Developing key concepts using graphic organizers such as word walls makes the concepts visual and establishes a useful reference for student use throughout the unit. Hands-on lessons on topics, such as the behavior of molecules in the atmosphere, the effect of glacial melt on sea levels, or how soil absorption of precipitation affects crop growth, can also help students connect local events with global patterns (see Resources).

Equipped with a basic understanding of the climate system, students then research local impacts of climate change as they select their topic. If students are new to independent research, they may need direction from the teacher to help them decide on a topic and pursue their research (*e.g.*, through a list of potential topics or links to authoritative websites and credible data sources). Steps that can help students identify their film topics include

1. group brainstorming,
2. web research from trusted sources,
3. a review of local news sources or other resources, and
4. bringing in local experts to present on topics.

One challenge of building climate science content knowledge through topics focused on local outcomes lies in the global scope of many existing climate resources. Websites for local or national government or state agencies often provide good starting points for exploring issues that are affecting communities (see Resources). Introductory exercises during which students connect an activity or interest of theirs with climate change (e.g., fishing and changes in stream volumes) can give students a starting point from which to begin their research. Students are also encouraged to write the definitions of scientific terms where they can be saved and viewed by all group members to support building a shared topical vocabulary.

Teacher guidance

Teachers must define the type and amount of scientific information students should use (e.g., films must include scientific data to back up claims; sources must be cited). Depending on the topic and the group, the research phase may take from 5 to 15 hours, with some research assigned as homework (see example time budget in Resources). It is helpful to show videos from scientific agencies such as NASA that demonstrate entertaining and accurate scientific communication (see Resources) and provide examples of appropriate use of humor in a documentary film. Teachers should also provide guidance about the expected film length. For in-class projects, a film length of one to five minutes is ideal. Longer productions may require some work to be done outside of class. It is also important to define the expected time budget for each step. A realistic time budget will help students be efficient (see example time budget in Resources). Teachers should also decide what types of films are acceptable. For example, will films need to follow a documentary style? May humorous or fictional elements be included? Humor can be an effective tool when communicating like climate change; but if humor is included, its boundaries need to be clearly defined. Teachers may want to discuss with students the appropriate role and boundaries of humor in their films. Students will likely want to create a short segment of bloopers to capture the funny moments that occur during filming, although it is up to the discretion of the teacher whether or not to include them in the final film.

Learning Objectives:

- Students will be able to define their research questions and what types of data are necessary to answer those questions.
- Students will understand which websites offer appropriate data and information for their research.
- Students will be able to identify the boundaries of their topic and define for themselves which data are outside of the range of the topic they are trying to address.

Materials: List of pre-vetted websites that have appropriate data and ideas, computers (enough for one for every 2-3 students), a space to take notes that can be shared with the group (paper notes work but need to be stored where they can be accessed by all group members)

Procedure:

- **Generate a list of research questions as a group-** When students are still considering multiple topics, it helps to have a single set of research questions to help them narrow down which topic most interests them. You can start with questions on the brainstorming handout: What is the topic? Why does it matter? How does it affect your community? If you have a large group, these questions can be assigned to individual students; if your group is smaller, you may want to do them together.

- **Supply accepted sites for students (also see below).** If your students are in middle school, they are probably not savvy enough to vet sources. A list of three sites is a good place to start. You may even want to start on one site together as a group, and walk through it before letting them explore a couple more on their own. If your students are more advanced, you can let them explore on their own after setting parameters (e.g., searching for sources on Google Scholar or looking only for sites that end in ".gov").

- **Define topic boundaries as a group and assign specific sub-topics to individual students or pairs.** Research tangents are enticing, and students will be inclined to lose focus if their topics aren't narrowly defined. Decide as a group what sub-topics are of interest (maybe even sub-sub-topics) and which are not. It helps to write down this list and keep it in a place where students can see it while doing research.

- **Have students take notes in bullet form and save them.** Students often want to record paragraphs which are hard to review later and can create plagiarism issues. You may be able to use a Google Doc or other shared file to preserve notes or students may have a science journal that they can use and access for each meeting.

- **Be clear on how the information is to be displayed/presented.** As researchers, we often multi-task our literature searches, finding citations for background information, methods, and data visualizations all in the same search. Students haven't learned how to do that yet, so it's good to be clear when you are searching for sources to help them pick their topic (for example) as opposed to looking for sources that will give them data projections that they will include in their film.

- **Selecting links for your students:** It's not always simple to find a good source to direct students to. The most factual site may have information that is hard for students to understand, while the most engaging site might not have much content. Here are some things to consider when looking for links to give to your group:
    - **Look for sites geared for educational audiences:** If the intended audience of the site is professional researchers, it will likely fly over the heads of your students or require you to walk them through finding information on the site.
    - **Be aware of which sites are linked to from the site you are giving them:** On some sites, it's good to follow additional links and get more information. On other sites…
    - **Recognize that there are different kinds of learners:** Some students will find verbal descriptions intuitive, while others will do better with images or tables. Consider sources that offer information in multiple ways.

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Lesson 3. Script/Treatment Writing (1 hour + possible outside time)

Overview: Students discuss their selected climate change topics in their groups and identify the data and interpretations that underlie current scientific understanding of those topics. Each group can report out to the class to practice talking about their topic. Drawing on their research, students also discuss the potential impacts of climate change on their community and possible mitigation steps. To structure their discussions about the science content, student groups build their own concept map (see "Brainstorming example" worksheet in shared Teacher Resources folder). *Concept maps* help students organize their ideas and visualize how they will use those ideas in their film. Concept maps also help students identify places where additional research is needed. Additionally, it is helpful to provide students with guiding questions, such as:

1. What scientific information is necessary to explain your topic?
2. In which ways does your topic affect our community?
3. Who are the local experts who could provide a community perspective on your topic?

Interviews with local experts can help students answer open scientific questions and expose them to alternative perspectives on their topic.

As students refine their scientific ideas, they identify the message they want to deliver and the target audience for their film (e.g., their peers or city council). Now, students should be ready and can be encouraged to summarize their film's message in three sentences or less. This summary highlights the film's purpose, the takeaway message, and audience of the film. The concept mapping helps students develop their synthesis. With their overall message in mind, students can decide on their story narrative and write a film script based on their revised concept map. Scripts outline the film plot and are written in prose with characters, dialogue, and setting.

Learning Objectives:

- Students will develop a brief overview of their film idea.
- Students will share their idea with other students in their group and give and receive constructive feedback.
- Students will decide which film idea to pursue as a group.
- Students will write a script that details the dialogue and action that will take place during the film.

Materials: Treatment Prompt handout

Procedure:

Have each of the students write a one- to two-paragraph synopsis of their film's story. Have them include settings, characters, action, interviews, etc. Each student will have different ideas; this will help ensure that every student's ideas are heard and discussed. Have each student "pitch" their synopsis to the group; then, have the group discuss and synthesize their ideas into a final script/treatment.

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Lesson 4. Storyboarding (2-3 hours)

Overview:

The final step of the research phase is the development of a storyboard from the script. A *storyboard* is a sequence of drawings with directions (e.g., camera placement notations and indications of character movement) and dialogue. Each cell in a storyboard represents one shot in a film and should include a stick figure drawing of the characters and their actions. Cells can be numbered to organize the order of the shots in the video. Storyboards help students stay organized throughout film production and editing and help them stick with their scientific message (see Online Supplemental Materials for storyboard template and story board rubric).

Learning Objectives:

- Students will translate the story detailed in their scripts into a series of drawings (storyboards).
- Students will understand the directions and details necessary to include with each storyboard.
- Students will develop a storyboard for each scene in their film.

Materials: Storyboard handout

Procedure:

Students translate their script/treatment into a visual plan. A storyboard is a sequence of drawings with directions (camera placement) and dialogue that represent the film's "shots." The storyboard is the guide for production that lists all of the shots needed and their order. This is a very important document, and we suggest you make several copies.