



LENS ON CLIMATE CHANGE

Teacher Handbook

The Lens on Climate Change is a great opportunity for students to explore how climate change affects their community in a hands-on project that allows them to pick their own topic and drive the creative process while learning film production skills.

Program Partners



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Overview of the Program

The Lens on Climate Change (LOCC) program engages middle and high school students in film production documenting the effects of climatic and environmental changes on their lives and in their communities. Middle and high school students are paired with graduate and undergraduate student mentors to research, film, edit, and ultimately screen their films and participate in a panel discussion. Each student group (4–6 students) is guided by both a science and a film mentor through the completion of the project. The science mentors are science graduate students from the University of Colorado; the film mentors are students from the Colorado Film School. Teachers form the liaison between student groups and the program team. The collaborative work with mentors from both a science and a technical career path provides the participating students with a unique way to explore STEM fields and careers.



Throughout the program, students participate in at least two field trips – one trip to the Colorado Film School to see and use some of their professional equipment and to the final screening event at the University of Colorado. During this campus day, students tour some campus facilities, have lunch with panelists from STEM fields, and visit some labs of their mentors. Then, all films from the student groups are presented in a festive, open-to-the public screening event. We further encourage each student group to screen their films for their local community or school.

LOCC is a project funded through a grant from the National Science Foundation. As such, it also includes a research component to assess how well this model of engagement works to teach kids about climate change. The research program uses a mixed-methods approach, which incorporates both quantitative results from surveys as well as qualitative results based on interviews and focus group data. These data are collected throughout the program from students, mentors, and teachers [see Research section for more detail].

Role of Teachers in LOCC

Help recruit students through sharing information about the program

- Manage parent and student consent and media release form return
- Organize space for group meetings
- Support students in completing tasks outside of set meeting times
- Classroom management and support of mentors during meetings
- Organize transportation and logistics for field trips
- Organize a control group for pre- and post-surveys
- Participate in field trips



Teachers in the program receive:

- Amazing experience for yourself and your students
- Technical and logistical support for the film production
- Travel expense for student groups during the field trips
- Technical equipment for students
- Teacher stipend \$500, plus program pays for substitute teachers during film screening and Colorado Film School field trips



Project Timeline

The film production process in the Lens on Climate Change (LOCC) program includes three phases:

Pre-Production (Research, Topic Selection, Scripting): During a kick-off meeting, students, mentors, and teachers brainstorm and distill topic ideas for the film. Supported by the science mentors, students create a concept map of their climate change topic from which they draft a script for their film, identify expert or stakeholder interviews (e.g., flood victims, park ranger, ranchers), and outline the footage that is needed with the support of the film mentors. This phase generally takes the first 5-6 meetings to complete.

Production (Filming): Drawing from the many climate experts at CIRES, CU, and other Colorado-based research institutes, students film interviews with content experts and stakeholders representing diverse viewpoints. The film mentors support the students in filming both the interviews and footage to intercut with interviews (B-roll). Students carefully plan B-roll filming days by identifying and scouting locations. Many groups use their CFS field trip day as an opportunity to film at locations away from their school, as the tour of CFS only requires part of the day. Science and film mentors help students find existing footage, audio clips, and still images to supplement their films. This phase generally takes 3-4 meetings to complete.

Post-Production (Editing): Following the storyboard, students edit their films with the help of film mentors and teachers, using free software packages. Film mentors guide students with respect to fair use and copyright for music and other licensed materials. Students will receive some LOCC staff support around image and footage research and interviewee and B-roll scheduling to ensure completion of the films. This phase generally takes 4-5 meetings to complete.

Final Screening Event: All films will be screened during a festive film screening. Screening audiences will include students' peers, teachers, parents, mentors, and the public. A panel of guest experts and student participants will discuss films at each screening. Students also answer questions from the audience about their films. The screening event is part of a visit to the University of Colorado campus, where students take a tour and participate in a college and career discussion with panelists from science and technology fields.



Month	Milestones	Activities to support hitting targets	Other activities
September/ October	Identify interested students (6-8 per group)		Application Survey (10 min)
	Introduction to LOCC, share past films	LOCC Program Manager visits groups with pizza/snacks	Pre-Survey (15 min)
October	Climate background; Topic brainstorming	LOCC Staff visit groups	
	Refine research topics	Finding your voice games Brainstorming activities (w/ science mentor)	
	Program check-in 1	Practice pitching topics in short vlog post to CU undergrads (w/ science mentor)	
November	Develop concept for film	Concept mapping (w/ science mentor)	
	Define the central story	Practice giving elevator speeches	
	Program check-in 2	Practice giving and receiving feedback with CU undergrads	
December	Intro to film	Dick Alweis [faculty, Colorado Film School] visits schools	
	Develop storyboards and scripts	Treatment breakdown into sequences; determine shooting sequence (w/ both mentors)	

Month	Milestones	Activities to support hitting targets	Other activities
January	Shooting	Touch base and define goals. Check out equipment and use sequence handout (w/ both mentors)	Colorado Film School field trip (and off-site filming?)
	Footage assessment	Take inventory of footage shot, identify where additional shooting needed (w/ both mentors)	
February	Final shooting/reshooting	Discuss sound design. Define goals and timeline for the remainder of project (w/ both mentors)	
March	Revisions/titles/credits	Add titles and credits. Make final edits (w/ film mentor)	
		Output final film	
	Final screening event		Field Trip to CU for film screening and workforce panel; final research surveys (30 min)





Getting Started

First things

Welcome to the program! We are glad that you have decided to join us, coordinating a team of young scientists as they explore the effects of climate change in their community. Once you have agreed to be part of this program, there are some initial steps that are needed to get you set up:

- **Check in with your administration:** we have approval from the district to run our program in schools, but it is still necessary to go through the channels at your school and make sure that they are supportive. Additionally, as part of our work with the school districts, we have descriptions of how our program aligns to the broader goals for each district and we would be happy to share information about how we align with your particular district's goals.
- **Start learning a bit about our program** so that you can answer student questions (and identify questions of your own!). We have a summary film and information on our website to help teachers learn about our program.
- **Distribute a copy of the parent information sheet** which you can customize with information for your school. While we want teachers to be able to encourage the students whom they think will benefit the most from the program to apply, we also want to be sure that all potentially interested students hear about the opportunity. [The parent information sheet is available in Spanish and English; please let us know if you want the Spanish version.](#)
- **Decide on a space and a time for your meetings:** Please identify a couple of possible times during which you and the students can meet. Ideally, students will have access to computers at least part of the meetings so that they can conduct research on their topics.
- **Think about a control group.** You will want to identify a similar-sized group of students to take the pre- and post-survey with the film-making group; these surveys will be administered to all students at the same time and pizza will be provided as an incentive to participate.

Selecting students

You will be recruiting a group of 6-8 students. We find that the easiest way to do this is to let all students know about the program (through a general announcement using the attached recruitment script or posting of the flyer); then, invite interested student to apply through our web-link – we have a short application form in which we ask students to explain their

motivation for participation (see Appendix). Alternatively, a member of the LOCC staff can visit your school and present the program to interested students and invite students to apply.

Teachers will be asked to rank students who apply as to which are most likely to benefit from the program and who are most likely to stay engaged and not drop out. Students who are selected for the program and their parents will be asked to complete a consent/assent form with respect to their participation in the research activities that accompany the program.

Control group recruitment: In one of the earliest meetings, staff from LOCC will visit and administer the pre-survey to both the control and film groups. At this meeting, pizza will be provided as an incentive for completing the survey; this provides an opportunity for students in both groups to ask questions about the program. Students in the control group will also need to complete a consent/assent form. At the end of the program, a similar meeting will be held for students to complete the post-survey.



Getting your mentors

Each teacher/student group will work with two mentors—a science mentor and a film mentor. Science mentors are graduate students from University of Colorado Boulder and film mentors are undergraduate film students from the Colorado Film School. Mentors will guide your students through the program. We select mentors to provide the necessary knowledge and skills, but we also anticipate that mentors will serve as role models for your students for college-track education and science/technology careers.

Mentors will be recruited by LOCC staff and chosen based on their experience in mentoring, the applicability and broadness of their scientific or film production interests, and their ability to travel to schools. Mentors will receive a training that introduces them to the program and helps them develop general mentoring and communication skills. **All mentors will undergo a background check appropriate for the districts in which they will be working.**



Your role as a teacher liaison

Teachers are primarily responsible for classroom management. Our mentors are enthusiastic and well-intended, but most do not have experience working with middle or high school students. Teachers should set initial expectations for behavior and participation with their students in the first meeting and help to maintain those standards throughout the program. Teachers may also have to help mentors to adjust the level of discussion so that it is appropriate for their students.

Past mentors have indicated that one of the most challenging parts of the program for them involved trying to keep students on-task. You know your students best! Share strategies for helping easily distracted or disruptive students with your mentors. Open communication between teachers and mentors helps maintain a respectful and productive classroom.

What happens in the regular meetings?

When your group meets for their regular meetings, the film and science mentors will meet your students and the mentors will guide the students in researching, selecting, and producing their films. Depending on where your group is in the process, students may need access to computers to research their topics, find images or audio they want to include, or do basic editing.

It is important that students have a reliable place to store their research notes and materials. Teachers in previous versions of the program have used electronic file-sharing (via Google classroom or similar) or a dedicated LOCC group folder that stays in the classroom. These documents are critical not only for the students' research, but also for the LOCC research program, which uses these to document the students' thought processes and the development of their group dynamics.

On days that students are filming or working with specialized editing software, the film mentors will bring equipment from the Colorado Film School to use. Most filming can take place on the school grounds, although occasionally groups will have a particular location at which they wish to film and LOCC staff can help arrange transportation or other logistical details.



Activities outside of regular meetings

In addition to the regular team meetings, two field trips are planned.

- 1) A visit to the Colorado Film School to tour their campus allows participants to see the equipment and spaces that the film students use in their own productions, after which some groups may want to take advantage of the availability of transportation and substitute-teacher time to do off-site filming. This field trip is planned for a Saturday in January.
- 2) A visit to the University of Colorado Boulder to tour campus, attend a college and career panel, and attend the film screening. Both of these trips will be coordinated to include all participating school groups, if possible. The CU trip occurs on a school day the week before Spring Break.

The screening event at CU is the culmination of the project; students' families are explicitly invited and the event is open to the public. At the screening, students introduce their films and answer questions from the audience. It is a celebratory event where the students' films are praised and appreciated.

Transportation for these field trips is arranged by teachers and reimbursed by LOCC. Substitute teacher fees are also covered. These trips are not mandatory but are strongly encouraged.





Research program

The Lens on Climate Change (LOCC) is a three-year program funded by the National Science Foundation. The project aims to spark student interest in science and technology, build science and technology skills in the students, and increase their career-readiness for STEM fields.

As part of this program, we assess its efficacy in meeting its goals. To do this, we use surveys, short focus-groups, and interviews, in addition to analysis of artifacts (handouts, drafts, etc.) and final films. These educational research activities are integral to the project and are necessary to ensure that the goals are being met and its impact is measured. This research component is a requirement for the funding we are receiving. We can only provide the program free of cost because of this funding.

What kinds of questions are being asked in the research?

The research surveys are designed to measure changes in climate change knowledge, attitudes towards STEM fields, and ideas about their own futures. In order to best determine the program's impact, we are using a treatment and control group design (*i.e.*, results from a group of students who make the films are compared to a group of students who do not). Student survey results are compared from the beginning and end of the program and also compared to survey results from the students in the control group.

If you would like to know more about the information we collect on surveys and how it is used to examine specific research questions, we would be happy to discuss it with you further. Contact the Program Manager (Erin Leckey) with any questions about the research program.

Keeping Student Information Confidential:

Any identifiable information of the subjects that we obtain for scheduling meetings or surveys in order to match pre- and post-surveys or interviews will be removed from the data file. Participant names will be cut off the paper surveys and replaced with a participant ID number. For any electronic survey that includes the name of the participant, the data will be downloaded and the participant name will be replaced with the participant ID number. A file that includes the participant names and the ID numbers will be password protected and only the research team will have access to the file.

Data will be stored on a password-protected computer in a locked office in a locked building on the University of Colorado campus. Only the research team and the evaluator will have access to the data. Participant feedback will be transcribed, de-identified, and stored (as described above). Any reporting will not include any identifiable information. No sensitive data will be collected. Data will be destroyed at the end of the program. Data collected as part of the research study will be de-identified, coded, and stored securely.



Teacher Professional Development Credit

In addition to the stipend that teachers receive for coordinating their group's activities, teachers can earn professional development credit through the University of Colorado. One possibility is that you develop lesson plans around the program activities of how to incorporate the model into a science classroom. Some examples of topics are: using cell-phone video to capture environmental change; editing film footage from internet sources for the use in the classroom; and aligning film production activities to Colorado science standards. Teachers are encouraged to follow their own interests and skills in deciding which topics to pursue. Please contact Erin Leckey if you want to discuss options for professional development credit.

Sample LOCC Lesson Plans

- a. Lesson Plans: Phase I Pre-Production
- b. Lesson Plans: Phase II Production
- c. Lesson Plans: Phase III Post-Production

Teacher Resources Available in Shared Folder

- Program Information and Forms
 - Parent Info Flyer
 - Recruitment Script
 - Consent Forms
 - Student Application Survey [completed online, if possible]
 - Teacher Media Release Form

- Student Research and Filmmaking Aids
 - Colorado climate change topic introductions
 - Accessing resources checklist
 - Brainstorming example
 - Internet site evaluation worksheet
 - **Know/W**ant to know/**L**earn chart
 - Preparing for research worksheet
 - Processing information checklist
 - Student self-evaluation worksheet
 - Work log
 - Guide to the Creative Commons
 - Film terminology glossary
 - Storyboarding worksheet



Lesson Plans

PRE-PRODUCTION		
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- 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

PRE-PRODUCTION		
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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.

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- b. **Phase 2 – Production:** Drawing from the many climate experts at CIRES, CU, and other Colorado-based research institutes, students film interviews with content experts and stakeholders representing diverse viewpoints. The film mentors support the students in filming both the interviews and footage to intercut with interviews (B-roll). Students carefully plan B-roll filming days by identifying and scouting locations. Science and film mentors help students find existing footage, audio clips, and still images to supplement their films. This phase generally takes 3-4 meetings to complete.

Production	Estimated Time	Worksheets
Lesson 5. Interviews	1-3 hours, + possible outside time	
Lesson 6. B-Roll	1-3 hours + possible outside time	
Lesson 7. Voice-overs and Additional Footage	1-2 hours	



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Lesson 5. Interviews (1-3 hours + time to review/watch footage and take notes on "good" answers)

Overview: Have students review their storyboard before interviews and discuss what answers they need (e.g., they may need a climate scientist to specifically talk about their region's forecast). Students interview the experts and subjects they identified in the pre-production research phase. Assign roles to the students, including interviewer, cameraperson, note taker, and follow-up questioner (they listen to the answers and are required to ask follow-up questions). If your group is larger than 3-4, then assign several follow-up questioners. Note takers should write the question asked, and notes about the answer given. These notes are helpful during editing because they provide a quick reference for "good" answers and clips.

Learning Objectives:

- Students will develop questions to ask experts on their film topics.
- Students will practice interviewing each other to become familiar with their own interview style.
- Students will propose potential follow-up questions that they might ask their interviewees.
- Students will conduct interviews with their content experts.

Materials: Voice-recorders (cell-phones can also be used), camera, and microphones



Procedure:

Filming and interviewing

Depending on the topic and the film genre students pursue, films may incorporate a mix of elements such as narration, expert interview footage, student-recorded footage of local landscapes or places, existing footage or still images, and animation. Storyboards provide a useful guide as students record their footage. Students are encouraged to organize their film files in shared folders (e.g., on Google Drive). High-quality footage can be captured with cell phones, tablets, and most still cameras. Interviews with scientists increase students' understanding of climate science. Local experts (e.g., state climatologist, scientists from a local research institute) can be invited to the school for interviews or can be interviewed remotely through Google Hangouts, Skype, or other virtual connections. The virtual interview can be captured through screen capture software or integrated recording options. Some science organizations offer other opportunities to virtually connect with scientists for student interviews (see Resources).

PRODUCTION		
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Lesson 6. B-Roll (1-3 hours, + possible outside time)

Overview:

B-Roll is the footage that goes over the interview footage. For example, if the interviewee talks about severe storms, the B-roll could be of dark clouds or storms. Referring to their Storyboard, students record the “shots” that are needed to make their film. Depending on the film’s story, these could be skits, dialogue between characters, or static shots. Have students review footage and take notes on their best clips or if they need to re-shoot something.

Learning Objectives:

- Students will review their film footage and identify places where additional imagery would help to provide context to their story.
- Students will use Creative Commons websites or their own footage to identify the additional imagery needed for their films.

Materials: Film recording equipment, laptops

Procedure:

Access to equipment is different for every school, but we emphasize creative ways to convey ideas or scenes with available classroom resources. Student groups can acquire film elements in various ways: through field trips to collect footage at sites away from their schools; creating whiteboard animations and drawings to depict situations that cannot be obtained through direct filming; and writing short skits that are acted out to convey ideas (see Resources). We suggest talking with students about appropriate filming locations (e.g., public spaces) and restrictions on other locations (e.g., private property without owner’s consent).



PRODUCTION		
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Lesson 7. Voice-Overs and Additional Footage (1-2 hours)

Overview:

Some videos will require narration or voice-over. These are just audio files that will be combined with the video files during post production. Other videos will require footage or photos from outside sources (e.g., scientific agencies).

Learning Objectives:

- Students use their storyboards to help them determine where additional narration or voice recordings need to be made.
- Students will practice recording each other reading scripted voice-over or narration material.
- Students will review their practice recordings and modify their scripts or narration styles to improve their message.
- Students will record final voice-over and narration material.

Materials: Audio recorders or cell-phones, laptops

Procedure:

As with interviews, voice-over and narration footage should be scripted and practiced, and several takes of each piece will likely be required. Students may also wish to include existing footage from other sources. Mentors and teachers can help students identify and download public domain files for this purpose (see Guide to Creative Commons).



POST PRODUCTION

- c. **Phase 3 – Post-Production:** Following the storyboard, students edit their films with the help of film mentors and teachers using free software packages. Film mentors guide students with respect to fair use and copyright for music and other licensed materials. Students will receive some LOCC staff support around image and footage research and interviewee and B-roll scheduling to ensure completion of the films. This phase generally takes 4-5 meetings to complete.

Post Production	Estimated Time	Worksheets
Lesson 8. Rough Cut Edit	1-2 hours + possible outside time	
Lesson 9. Revise	3-6 hours + possible outside time	
Lesson 10. Titles/Credits/Music	1 hour	



POST PRODUCTION		
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Lesson 8. Rough Cut Edit (1-2 hours + possible outside time)

Overview:

Once students have completed their initial filming, reviewing and assembling the footage allows them to get a sense for where additional footage is required to tell their story. The rough cut is a first draft of a film where the essential pieces are together in order. Once a group is satisfied that they have the basic components assembled, they should show the rough cut to other groups, if possible. The process of giving and receiving feedback, as well as learning how to incorporate that feedback, are critical steps to developing a good film.

Learning Objectives:

- Students use editing software to review their footage and decide which clips to incorporate into their film.
- Students determine the best sequence of shots to convey their story.
- Students evaluate their rough cut to determine when they are ready to show it to others and receive feedback.
- Students give and receive constructive feedback on their rough cut.
- Students determine which suggestions from their peers to incorporate into their film.

Materials: Laptops

Procedure:

Have the students assemble their video according to their storyboard. Do not worry about transitions or minor edits, because this is meant to be a very rough assemblage of the film. Create an editing plan where each student has a role and section that they are responsible for (e.g., one student could review and edit an expert interview, another could work on a particular sequence or skit). This initial cut will be longer than the final cut. Review the rough cut and compare it to their storyboard. Remember that every film is different from its original plan in some way and, in many cases, the final film is better than the initial plan.

Editing

During the postproduction phase, students assemble their footage into their finished film. Students can save time by shooting their films in sequential order, but post-production editing is required for complete and coherent end-products. Editing can be done using free, intuitive software packages (see Resources for suggestions). Most editing software has three basic components—a bin, a timeline, and a viewer. The *bin* shows all the footage from the camera, but can also be used to hold other footage or

still images. The *timeline* is a display of all video and audio tracks in the film. Students select footage from their bin and drag it to the timeline to arrange their film. The *viewer* shows the final film based on the timeline.

Evaluate

Students create a *rough cut* of their film by ordering the best clips from each scene according to their storyboard. Students then share the rough cuts with other groups or the whole class for feedback and constructive critique. Students use guiding questions (addressing science message and presentation) when watching and critiquing the rough cuts of other groups:

- What is the main message of the film?
- Is the science clear and well communicated?
- What was your favorite part of the film?
- Why were certain production decisions made (e.g., graphics, interview footage, humor)?

Students are guided to frame feedback in a positive and constructive way. The teacher should model how to provide constructive feedback and help students phrase their feedback in positive, helpful ways. Students then use their peers' feedback to create a *final cut* of their films. Edits could include changing the order of scenes, cutting scenes, or adding clarifying information such as text, images, and graphics. During the creation of the final cut, students add elements such as titles, credits, music, and sound effects (see Resources).



POST PRODUCTION		
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Lesson 9. Revise (3-6 hours + possible outside time)

Overview:

Based on the feedback from their peers, and on their own self-evaluation, students will continue to refine their films. This process is generally more about removing unnecessary footage than adding in new footage, but students may find that they need to re-shoot key scenes to tell their story in the most compelling way. During revisions, students will also want to ensure that transitions between scenes are smooth and that each scene begins and ends at the correct place.

Learning Objectives:

- Students work with their group to evaluate and refine their films.
- Students use editing software to add transitions between scenes.

Materials: Laptops, projectors (optional)

Procedure:

Students review their films and decide as a group where edits are needed. Students can either work together (by sharing a single computer screen or by using a projector) or divide up sections of the films and have pairs or individual students edit independently. All students should have a chance to review the film in its entirety and agree on the edits before the film is complete.



POST PRODUCTION		
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Lesson 10. Titles/Credits/Music and Final Editing (2-3 hours)

Overview:

Students add titles, credits, and additional sound or music to their films. They also review their films and make final edits.

Learning Objectives:

- Students self-evaluate their films and determine where additional sound effects or music are needed.
- Students use appropriate websites to find additional sound material.
- Students create title and credits sequences for their films.
- Students review films and make final changes.

Materials: Laptops, projector (optional), Guide to Creative Commons

Procedure:

As students review their films, they may find that they want to add additional sound effects or music. Students will also want to add in titles at the beginning of their film and credits at the end. Standard title and crediting templates are available in most editing software.

The final editing process can become long and involved, if the students are heavily invested in their films. Encouraging students to share their films with each other, giving and receiving feedback can help identify the most critical edits as well as gaps in the flow of the film.

