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CourseSource

Lesson

Using Current Events to Teach Written, Visual, and Oral Science Communication

Emily A. Lescak[1] and Katharine C. Kelsey[1,2*]

[1]Department of Biological Sciences, University of Alaska Anchorage

[2]Geography and Environmental Science Department, University of Colorado Denver

Abstract

Science, technology, engineering and mathematics (STEM) professionals need the skills to communicate with both technical and public audiences, but formal training in these skills is often lacking. In the nine-hour unit presented here, students learn to recognize the value of science communication, explore the process of distilling and translating scientific information for general audiences, and produce written, visual, and auditory science communication products in a collaborative setting. Undergraduate education is an ideal time to set the foundation for best practices in science communication, because as students move through their undergraduate careers, they become subject matter experts in scientific topics that are pertinent to many aspects of daily life. In this unit, students use locally-relevant current events as a focal point for exploring the significance and techniques of effective science communication. Further, students explore connections between their backgrounds and current scientific developments, explore and share their interests and experiences in STEM, articulate their educational goals, and advocate for themselves. By the end of the unit, students will produce three science communication products (written, visual, and auditory) on a locally-relevant event of their choosing. This unit provides students with an opportunity to practice science communication and engage in self-reflection on the influence of science on their daily lives and their interests and goals as young scientists.

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Supporting Materials: Supporting Files S1. Science Communication – Example Rubric; S2. Science Communication – Lecture Presentation Slides; S3. Science Communication – Example Video; and S4. Science Communication – Sample Metacognitive Exit Survey.

***Correspondence to:** University of Colorado Denver; katharine.kelsey@ucdenver.edu

Author Contributions: Both authors contributed equally.

Learning Goals

Students will:

- Recognize the value of science communication
- Gain experience with written, visual, and auditory communication
- Identify evidence-based statements and statements not based on evidence in science communication

Learning Objectives

Students will be able to:

- Identify scientific themes in local and global current events
- Identify when scientific information is or is not communicated in a manner accessible to a general audience
- Evaluate scientific information to distinguish evidence-based statements from statements not based on evidence
- Explore the use of written, visual, and auditory methods of communicating scientific messages from local current events
- Explain the importance of translating a scientific message for a general audience

INTRODUCTION

Science communication is a vital skill for professionals in science, technology, engineering and mathematics (STEM) fields and is also recognized as an important factor in increasing scientific literacy among the general public. Science communication education occurs in different capacities, including training to deliver presentations to public audiences (1), targeted efforts encouraging young scientists to distill information for elementary students (2), and a growing movement to train science communicators in the value and effectiveness of storytelling (3,4). However, despite these efforts and the importance of science communication skills for STEM professionals, specific training is lacking in many traditional higher education settings. Current research increasingly recognizes the need for enhanced training for STEM students starting at the undergraduate level (5).

Here, we introduce a unit including three lessons designed to emphasize the importance of science communication and give students the opportunity to develop and translate their own audience-specific scientific messages. Students communicate their messages through creative written, visual, and auditory methods. This material was originally designed as a nine-hour workshop delivered over three sessions but can be taught as a stand-alone unit or incorporated into a lower or upper division undergraduate science course. The unit is modular, so instructors could choose to teach only one or two of the lessons (e.g., written and oral communication) rather than all three.

This lesson was originally designed for undergraduate students who are part of the Alaska Native Science and Engineering Program (ANSEP) in Anchorage, Alaska (http://www.ansep.net/), and was specifically developed to be of interest and use to Alaska Native students. Therefore, in addition to including critical communication skills identified by experts, such as identifying the purpose and intended outcome of communication efforts, understanding the target audience, using appropriate language, and choosing an appropriate mode of communication (6), this unit also emphasizes skills necessary to communicate traditional knowledge through multi-modal forms of communication (http://eloka-arctic.org/communities/yupik/). Specifically, this unit employs techniques that are aligned with Indigenous ways of teaching and learning that are often lacking in a traditional, Western, higher-education classrooms, including a focus on place-based topics, work in small groups, student learning by observation, emphasis on visual and non-verbal learning, and storytelling (7).

In this unit students explore three different modes of communication: written communication in the form of short-format popular science writing, visual communication in the form of a video or Instagram post, and oral storytelling and interviews. All material in this unit is delivered in a student-centered learning approach consistent with the recommendations of the *Vision and Change* report (8).

Intended Audience

The intended audience is undergraduate students of any science discipline, either majors or non-majors. We taught this unit as an introductory-level workshop to two sections of approximately 15-20 students; however, we believe this unit could be easily adapted for an upper division undergraduate course. The unit could also be appropriate for a larger course with modifications but would be most effectively taught in a class size of 30 students or fewer to provide students ample opportunity for personalized and peer feedback. We include suggestions of how this unit may be adapted to different levels and different size classes.

Required Learning Time

The total instruction time for this unit consists of one 45-minute session and two 30-minute sessions. Students will need time to work in groups for approximately 2 hours following each class session, and this can happen either during or outside of class. We divided this unit into three three-hour segments which included both time for instruction and abundant time for students to participate in small group work with intermittent interaction with instructors.

Prerequisite Student Knowledge

The students do not need any specific prerequisite scientific knowledge but should have a basic understanding of current events and fundamental written and oral communication skills. For example, they should be able to provide examples of science-related news or be able to find relevant and reputable secondary literature. They should also be able to write concise summaries of articles and be able to ask and answer focused questions. We did not allot time in our lesson to teach or review basic skills in writing or presenting, but these elements could be added by the instructor if necessary.

Prerequisite Teacher Knowledge

The instructor should have a basic knowledge of managing group work and active learning settings and be prepared to oversee active learning strategies, such as Think-Pair-Share, collaborative work, interactive lecture, metacognition/reflection, and jigsaw.

The instructor should be able to explain why science communication is important for society. They should be able to identify examples of scientific ideas in the news, specifically local current events. They should feel comfortable explaining the importance of "translating" dense scientific information for general audiences. Finally, they should be familiar and comfortable with the methods used to share scientific information with the public, including examples of written (popular science articles), visual (videos and images), and auditory (radio or podcasts) methods. It would also be beneficial to have the background and experience to help students with internet searches and identify credible scientific sources. If an instructor does not have these skills, we recommend they team up with a school librarian. Many universities also include information on their websites to help students identify credible sources (e.g., https://sites.umuc.edu/library/libhow/credibility.cfm). Another possible resource would be an instructor from English and/or Communication departments with expertise on writing for general audiences and public speaking. Collaborations could also be made with visual arts and graphic design instructors.

SCIENTIFIC TEACHING THEMES

Active Learning

This unit employs many active learning strategies to help students engage with science communication concepts. Interactive lectures are used to introduce the basics of science communication, brainstorm current event topics, and identify the intended audience. Throughout the unit students engage in collaborative work as they pair up to produce written, visual, and oral communication pieces on their current event topic. In the first lesson, students use Think-Pair-Share to complete an icebreaker activity (describing a picture) and when reading and interpreting popular science articles. They engage in reflective writing when they listen to auditory science communication (we used ScienceTapes interviews) and reflect on how they relate to the subjects. Finally, the students provide anonymous feedback on index cards following the first two lessons and complete an online survey at the end of the third lesson. The use of these strategies in the unit is further outlined in the Lesson Plan (Table 1).

If interested, an instructor could add further active learning opportunities such as a gallery walk to allow students to provide feedback on each other's visual products or a jigsaws to share writing and visuals among members of different groups.

Assessment

Students self-evaluated their learning through reflective questions answered at the end of each lesson and by sharing final products with their peers and instructors for feedback. Instructors engaged in frequent discussion with each student group as they worked on their communication pieces to promote formative assessment and provide guidance, support, and feedback.

Instructors can measure learning by evaluating the final products students presented to the class. Because the students did not receive grades for this unit when taught as a workshop, we emphasized student experience and did not formally evaluate final products. However, we have included a sample rubric that can be used for each of the writing, visual, and auditory products in the supplemental materials (Supporting File S1. Science Communication – Example Rubric). We recommend sharing the rubrics with the students at the beginning of the lesson so that they understand the expectations. The instructors also used the student surveys to evaluate learning outcomes.

Inclusive Teaching

Several inclusive teaching practices are specifically included in this unit, with particular emphasis on techniques that align with Indigenous ways of teaching and learning. These practices include place-based and student-chosen topics, small group work, close observation and emulation of modeled best-practices, visual and non-verbal learning, and storytelling. Further, the unit leverages the diversity among students by providing multiple opportunities for every student in the class to share their work, thereby providing a voice to every student in the classroom. For students who are uncomfortable sharing in large group settings, we suggest opportunities for Think-Pair-Share and written reflections.

LESSON PLAN

Pre-Class Preparation

Prior to the start of the unit, the instructor needs to identify examples of science communication to share with the students. These include popular science articles for the written component, examples of visuals for the visual component, and examples of auditory science communication for the oral component. We recommend articles from IFL Science (https://www.iflscience.com/), videos created by Pleuni Pennings (https://pleunipennings.wordpress.com/film-project/) or this video of a home-made animation of the ecological effects of beaver dams (https://www.youtube.com/watch?v=IAM94B73bzE), and interviews conducted by ScienceTapes (https://sciencetapes.org/).

We also created our own visual products (a homemade movie and a photo/visual series) so that we could get a sense of what we could reasonably expect our students to produce during the available time period (Supporting File S3. Science Communication – Example Video). We shared these products with the students as additional examples.

Lesson 1: Written Communication

Lesson 1: Student Product: Students select three headlines or tweets about their chosen scientific topic (e.g., a proposed mining operation in Alaska is expected to have negative effects on salmon fisheries).

Lesson 1: Introduction

We were new instructors to the students, so we began with introductions of ourselves and the research that we do. We also provided examples of how we use science communication in a variety of ways (e.g., outreach, scientific meetings, peer reviewed papers, grants, advocacy).

Ice Breaker

We showed the students an image (in our case, of elephants and hyenas) and asked them to spend three minutes writing a detailed and accurate description of the image for someone who had never seen it. At the end of the three-minute period, we asked students to Think-Pair-Share to discuss their responses and particularly what parts of the description made it clear and compelling to the listener. We asked for a few volunteers to share with the whole class. The take-home point of this exercise is that the students find they can provide a more compelling description of the image if they produce a narrative about the picture as they describe what they see and put the relevant information in context. In our example, in addition to describing how many animals and trees they observe, they can improve the effectiveness of the communication by adding that the scene is in the savannah, the hyenas appear to be attacking the elephants, and the elephants appear scared.

The purpose of this exercise is to get the students into the mindset of crafting narratives and messages and to convey the importance of being descriptive and providing appropriate context. This activity also underscores the idea that a good visual can be very informative and lead to additional questions. It is important to make the distinction that scientists do not make up stories but craft narratives based on careful observations. An extension of this exercise would be to ask students to develop methods to test hypotheses or conclusions from the 'narrative' they have used to describe the image.

Interactive Lecture

We finished the introduction by reviewing the unit objectives and the schedule. Then, we used an interactive lecture with questions to the class to explore the many ways in which science communication is important (Supporting File S2. Science Communication – Lecture Presentation Slides). For example, we asked questions like "Why is it important to communicate scientific information to the public?" "Do you think there are some strategies that are more effective than others to communicate scientific information?" and "How is the exercise you just completed (describing an image) relevant to science communication?" [Potential answer: People have a much easier time understanding information when it is presented in narrative format with appropriate context.] Finally, be sure to take the time to discuss with students that Science Communication is an entire field of practice and study, and not something that can be mastered over the course of a lesson or workshop. This unit is designed to provide students with a preview and first experience with science communication.

Lesson 1: Activity 1: Reading Popular Press Articles

Students were divided into pairs or small groups to read popular science articles. Each group read a different article we provided (we used articles from https://www.iflscience.com/). We asked students to individually free-write a response to one of the following questions with regards to the article they read: How is science important to our daily lives? Where does scientific information come from? Why is science communication important? (Supporting File S2. Science Communication – Lecture Presentation Slides). We then asked them to swap papers with a partner and add to each other's responses. Lastly, we asked each group to report out a summary of their article and techniques used by the author to communicate effectively as well as ways in which the author could have communicated more effectively.

Lesson 1: Activity 2: Picking Focus Topics

Students engaged in a Think-Pair-Share activity and a group brainstorm to generate a list of potential locally-relevant topics to focus on for the remainder of the unit. Students were asked to brainstorm in groups for 10 minutes and generate a list of current events prevalent in the news (Supporting File S2. Science Communication – Lecture Presentation Slides). Each group shared with the class, and we recorded appropriate science-related suggestions from the students' brainstorm on the board (Supporting File S2. Science Communication – Lecture Presentation Slides). To determine the topic on which each group would focus for the lesson, we asked students to write their name and top three choices down and turn them in to the instructors. We then gave the students a ten-minute break while we divided them into small groups to tackle the different topics, and we then let students know the groupings. Note that we decided to form groups in this way rather than letting students choose their group members to give all students the opportunity to work on a topic that was of interest to them and potentially group students who would not ordinarily work together. In settings where students may need to meet up outside of class, it may be appropriate to form groups based on their availability to meet outside of class.

Lesson 1: Activity 3: Written Communication

Interactive Lecture

We used an interactive lecture to review credible sources, primary versus secondary literature, and help students identify scientific statements based on evidence. We prompted students with questions like "What makes a source credible, and how do you know if you can trust information?" "What is an example of an evidence-based statement" and "What is an example of a statement not based on evidence?" Most students were familiar with these distinctions, so this overview was quick and straightforward. Depending on the available time and level of teacher familiarity with this topic, this might be a good opportunity to incorporate the expertise of a librarian. If students are less familiar with these distinctions and/or time is available, this could be a good opportunity to introduce the CRAAP Test (e.g., https://libguides.cmich.edu/web_research/craap), which helps students identify credible sources.

Written Communication Activity

The task for the first lesson is for each group of students to write a summary of their assigned topic with three accompanying headlines or tweets (Supporting File S2. Science Communication – Lecture Presentation Slides). We gave students about an hour to find relevant articles on their topic and produce their written product. We provided assistance when necessary and checked in with each group individually multiple times. Afterward, we asked each group of students to share one headline or tweet they had written. Instructors may want to provide several reminders of the time remaining to students to keep them on track. At the end of the session, students turned in their written pieces. In our case, each group produced a Google doc that they uploaded to a shared folder.

Wrap-Up

At the end of the lesson, students were asked to individually and anonymously reflect on an index card about their contribution to the group and what they can do to make sure that they and their partner are both contributing. The goal of this exercise was to encourage student reflection and provide an opportunity for students to anonymously raise concerns about group work (Supporting File S2. Science Communication – Lecture Presentation Slides).

Lesson 2: Visual Communication

Lesson 2 student product: video or photo series that illustrated the scientific topic (Supporting File S3. Science Communication – Example Video).

Lesson 2: Introduction

We began the second session by reviewing our overall objectives for the unit and introducing the schedule (Supporting File S2. Science Communication – Lecture Presentation Slides).

Jigsaw: Review Previous Lesson

As a 'warm-up' for the day, we arranged students into 'review' groups such that each pair or small group from the previous lesson was split up. Each student had several minutes to describe the topic they were researching to their 'review' group and to share the headlines that they prepared in the previous session. This activity gave students the opportunity to remember their own topics and share what they learned with their peers.

Lesson 2: Activity 1: Visual Communication

We introduced the objective Lesson 2, which was to create a visual product – either a video or photo series – that illustrated their topic (Supporting File S2. Science Communication – Lecture Presentation Slides). Students were instructed that their visual should communicate: 1) Why the audience should care about the topic? 2) How science is helping us understand the topic? 3) What are the future questions that need to be answered? and 4) What the students themselves learned and how it changed the way they think? We required that all visuals be created by the students; for example, they were not allowed to download and compile photos from the internet. Videos needed to be two to three minutes in length, and photo/image series needed to contain 5-10 images.

Interactive lecture with examples

We started with a brief interactive lecture in which we prompted students with questions like: "Why is it important to consider the audience when preparing an educational visual?" and "How might your message change depending on the audience?" We also showed several examples of visuals that we found on the internet plus the examples that we made (Supporting File S3. Science Communication – Example Video).

Create piece of Visual Science Communication

Students returned to the same student group from the first lesson. Students had about 75 minutes to create their visuals, which we asked them to upload to our shared Google Drive folder.

Share student work

We then took about 20 minutes to have each group share their visual with the class.

Wrap up: Debrief

We ended the lesson with a brief discussion of why visuals are important, linking back to the previous session's icebreaker activity in which students told a story about an image. Finally, we conducted an informal debriefing of what was gratifying and challenging about completing the task. This could be an opportunity for students to provide anonymous critiques of each other's work, which could serve several purposes, including 1) learning to provide and receive constructive comments and 2) ensuring that the class is paying attention during presentations.

Lesson 3: Audio Communication and Storytelling

Lesson 3 student product: record and transcribe interviews with peers (e.g., ScienceTapes).

Lesson 3: Introduction

We began the third session with a reminder of our overall objectives (Supporting File S2. Science Communication – Lecture Presentation Slides). The first time we taught this lesson, we also did a mock interview between the two instructors to provide an additional model. We asked students to write down two questions that they had for us and then the instructors took turns asking each other a subset of the questions. These interview models set the tone and expectations for the types of questions that should be asked, how to provide a direct and detailed answer, and how to engage in back-and-forth dialogue between interviewer and interviewee. The mock interview between instructors had additional benefits of allowing the students to get to know the instructors and validating their abilities to ask good questions. The students were obviously enthusiastic when their questions were asked.

Ice Breaker: Listen to an Interview

We had the students listen to several examples of interviews done by ScienceTapes (https://sciencetapes.org/). We chose ScienceTapes interviews with early career scientists (undergraduate students) because their stories were relatable to our students. In their groups, we asked students to reflect on the interviews, specifically what they learned, the concerns of the interviewee, what inspired the interviewee, the extent to which the students could relate to the interviewee, and what parts of the interview were particularly effective (Supporting File S2. Science Communication – Lecture Presentation Slides). Resources for students preparing interviews are available from the CourseSource lesson, "A How-to Guide for Producing Interviews" (7). Following the interviews, we asked each group to report out to the whole class.

Lesson 3: Activity 1: Audio Communication and Storytelling

The students had about 75 minutes to record and transcribe interviews with each other in which each student was encouraged to tell the "story" of how they became interested in science and in the particular topic they are exploring in this unit (Supporting File S2. Science Communication – Lecture Presentation Slides). We asked each student to come up with about 5 questions to ask their partner and provided some suggested questions to get them started (Supporting File S2. Science Communication – Lecture Presentation Slides), including

- What have you learned about your group's issue?
- What interested you initially about your topic?
- What do we have left to learn?
- What inspires you?
- Tell me about a personal experience related to your topic.
- What concerns do you have about your topic?
- How is science helping address or understand your topic?
- How does science help explain things that you have observed?

After completing the interviews, which the students recorded on their phones, we asked them to upload the recordings to computers and then download a trial copy of Trint, a transcription program. Note that if students do not have cell phones or if they are not allowed, interviews can be recorded on computers. We found that if the students used their phones, they were able to spread out in the room or hallway to reduce background noise. Students uploaded their recordings to Trint's website for transcribing, pasted the transcript into Word, and then formatted it for readability. We asked students to add both their recorded interview and their transcript to our shared Google Drive folder. We then played each interview to the whole class, so the students had the opportunity to share their work. We found the students were responsive to listening to each other's interviews, but it was apparent that some students were uncomfortable hearing their recordings. As a result, teachers may want to consider asking students to volunteer to have their interview shared, or give groups the option to share just a portion of their interview. While the interviews were playing, we used their transcripts and summaries (from Lesson 1) to create a word cloud using free online software. This served as a fun visual to highlight major themes that emerged among the students' topics.

Wrap-Up

The final 10 minutes of the workshop were used to have students complete a metacognitive exit survey that we designed to reflect on their learning from the workshop and to provide formative feedback to us as the instructors about the effectiveness of the workshop (Supporting File S4. Science Communication – Sample Metacognitive Exit Survey).

TEACHING DISCUSSION

Lesson Effectiveness and Student Response

Nearly all of the students were active participants in each of the three lessons. Each pair/group of students succeeded in producing written, visual, and oral content. We found that by and large students appreciated the opportunity to talk about current events, and to reflect on how science influences their daily lives, and to share why they decided to devote time to furthering their STEM education. Given the popularity of podcasts, Instagram, and YouTube, students enjoyed having the chance to be creative and develop original content. By giving students options for the formats of their final products (e.g., writing headlines versus tweets, drawing images or taking pictures, and choosing their own interview topics and questions) as well as the topics, they could exercise their voice and choice. It supported the creation of diverse products and an inclusive learning environment because students could design products that reflected their own strengths and interests.

The survey results assessed the extent to which students achieved our learning goals, which were to 1) recognize the value of science communication; 2) gain experience with written, visual, and auditory communication; 3) and identify evidence-based statements and statements not based on evidence in science communication. Students articulated that science communication "creates a bridge between scientists and other people" and "helps spread accurate information about topics that are important to the people. It ensures that important news is received by everyone so that the world is more informed and knowledgeable." They understood that science informs decisions that people make regarding diet, the environment, land use, ecosystem services, weather conditions, engineering, and technology. After completing the unit, students said that they were motivated to communicate more with others and help them improve their communication skills, use language that audiences can understand, take more time to observe their surroundings, create new ideas, work with teams, be positive, convey information more accurately, be more open about taking in news, have more confidence, and practice their public speaking.

Students also reported that they learned that to be effective communicators and that they need to ask questions, take themselves out of their comfort zones, talk to people, adjust their language to meet their audience, make connections with their audience, be descriptive and understanding, say things in their own words, use visuals, and take their time explaining concepts. They said that the most effective and useful parts of the unit were gaining skills in interviewing, getting insight into the scientific community, getting practice public speaking, gaining a better outlook on the world and opportunities after high school, being able to do research, and learning to communicate clearly and descriptively.

We also emphasized the point during the final lesson that one of our goals for the students is to provide them with skills to find and articulate their own voices. Being early career scientists ourselves, we are familiar with the frustration that comes with having important things to say and not having our voices heard. It was important to us that we give our students the tools to craft meaningful arguments and articulate themselves in a mature and professional way.

Reflection and Potential Changes

Groups versus Pairs

The first time we taught this unit, we divided the students into groups of three to four, which we found gave some students the opportunity to 'hide' and not participate fully. The second time we taught it, we grouped students in pairs, which meant that each student had to play an active role. We had greater success with student participation when the students worked in pairs.

Choosing Focus Topics

The first time we taught the unit, we presented the students with a list of topics they could choose from that were locally relevant to our lives in Alaska (e.g., climate change, mining, fishing), whereas the second time, we gave the students the chance to brainstorm more broadly. Based on these experiences, we recommend a hybrid approach in allowing students the opportunity to brainstorm current events but making sure that they are locally relevant issues and also including some topics suggested by the instructor. In doing so, students will likely be able to relate to the topic that they are researching in a more meaningful way.

Showcase Student Work

Lastly, we wish that we had the opportunity for the students to showcase their work to a wider audience. We encourage instructors to find a way for their students to demonstrate what they have done to a larger community.

SUPPORTING MATERIALS

- S1. Science Communication – Example Rubric
- S2. Science Communication – Lecture Presentation Slides
- S3. Science Communication – Example Video
- S4. Science Communication – Sample Metacognitive Exit Survey

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Table 1. Lesson plan timeline.

Activity	Description	Estimated Time	Notes
Preparation for Class (30 – 60 minutes per lesson)			
Lesson 1 Preparation Identify popular science articles	Identify and print popular science articles for each student group/pair. Optional: Create GoogleDrive folder or Blackboard location where students can upload finished work to view as a class.	30-60 minutes	• We used IFL Science articles (https://www.iflscience.com/). • Other possible sources for articles include local newspapers. For example, we referred students to the Anchorage Dispatch News' website.
Lesson 2 Preparation Identify examples of visuals	Identify examples of visuals (both pictures and video) to use as examples.	30 minutes	• Ensure the examples are appropriate for student skill level. Consider making your own visual as an example and to understand a realistic product (Supporting File S3. Science Communication – Example Video). • Asap Science is a good source of example videos: https://www.youtube.com/channel/UCC552Sd-3nyi_tk2BudLUzA. • Another good example: https://www.youtube.com/watch?v=IAM94B73bzE.
Lesson 3 Preparation Identify example interviews	Find example (short) interviews. Review Trint app if using for transcribing student interviews. (https://app.trint.com).	30 minutes	• We used Science Tapes (https://sciencetapes.org), because they are short and locally relevant to our students. • Other possible sources for interviews include RadioLab or Story Collider.
Lesson 1: Written Communication (~2.5 hours; including group work time)			
Icebreaker: Creating narratives	Show students a dynamic photo. Ask students to write a description of the photo for someone who has not seen it. Students share what they wrote with their partner. Prompt a class discussion about what techniques best convey information.	8 minutes	Suggested technique: think-pair-share; Lecture slides with notes are in Supporting File S2. Science Communication – Lecture Presentation Slides.
Importance of science communication	Introduce objectives, schedule, and why science communication is important.	10 minutes	Suggested technique: Interactive lecture.
Activity 1: Reading and discussion of science articles	Students read popular science articles in pairs and respond to the questions: How is science important to our daily lives? Where does scientific information come from? Why is science communication important?	20 minutes	Suggested technique: Think-Pair-Share.
Activity 2: Picking focus topics	Students discuss current events. Ask students about what stories they are hearing in the news. Students brainstorm in pairs and then report to the whole class. Write appropriate suggestions on the board. Narrow down list to those that are related to science.	10 minutes	Example topics are in Supporting File S2. Science Communication – Lecture Presentation Slides. Suggested technique: Think-Pair-Share and Group Brainstorm.
Assign students to topics	Ask each student to write down their top three choices for topic. Break students into pairs.	15 minutes	After the students turn in their top three choices, it is a good opportunity for them to take about a 10 minute break.
Activity 3: Written communication	Review credible and primary versus secondary sources and evidence-based statements. Introduce the task for the day.	15 minutes	Suggested technique: Interactive lecture; Lecture slides with notes are in Supporting File S2. Science Communication – Lecture Presentation Slides.

Activity	Description	Estimated Time	Notes
Written communication activity	Students work in pairs to find relevant articles on their topic, write a paragraph that summarizes their topic, and develop three tweets or headlines. Afterward, ask each pair of students to share a headline/tweet they have written.	1 hour	Suggested technique: Collaborative work.
Wrap-up	Students write anonymous reflection about what their contribution was to the group and what they can do to make sure that they and their partner are both contributing.	10 minutes	Wrap-up questions in Supporting File S2. Science Communication – Lecture Presentation Slides.
Lesson 2: Visual Communication (~2.5 hours; including group work time)			
Introduction	Review objectives of Science Communication Lesson sequence.	3-4 minutes	Supporting File S2. Science Communication – Lecture Presentation Slides.
Review previous lesson jigsaw	Arrange students into groups of 3-4 such that each pair is split up. Have students take several minutes to describe to their group the topic their pair is researching and the headlines that they prepared in the previous session.	10 minutes	Suggested technique: jigsaw. The objective is to remind students of their topic and transition into the class for the day. It also gives students a chance to hear a bit about what other pairs are researching.
Activity 1: Visual Communication (Lesson Objective)	1. Introduce the Objective for Day 2 of the Science Communication Lesson sequence: "Create a visual (video or Instagram post) that tells your story. 2. Outline expectations for visual: They are creating the type of visual you would find online if you were hoping to learn more about a topic—like a YouTube video or a short image documentary.	5 minutes	Supporting File S2. Science Communication – Lecture Presentation Slides. We have also seen students prepare a cartoon, poster and a book as their visual. For an example, see Supporting File S3. Science Communication – Example Video. Remind students that they are not making a report or a PowerPoint.
Interactive lesson with examples	Prompt students to think about why it is important to consider their audience when preparing an educational visual like for this lesson. Ask them how their message may change depending on who they are talking to. Show examples.	25 minutes	Suggested technique: Interactive Lecture; Supporting File S2. Science Communication – Lecture Presentation Slides.
Create piece of visual science communication	Collaborative work: Students work in their pre-assigned pairs to prepare a visual of their choosing.	75 minutes	Assist students by giving them a timeline: 20 minutes to make a plan, 30 minutes to create or collect images, 30 minutes to edit or finish up. For students creating videos—introduce them to the free online video editing platform WeVideo.
Share student work	Each group takes several minutes to share their visual product with the class.	20 minutes	If groups are producing their visuals digitally, have an online platform such as GoogleDrive or similar where students can upload work so you can show it to the class.
Wrap up: Debrief	Use remaining time to debrief the activity for the day and to remind students how this type of visual may play an important role in helping the public learn about important topics.		If time allows, ask students to share what was challenging and gratifying about the day's work.

Activity	Description	Estimated Time	Notes
Lesson 3: Audio Communication and Storytelling (~2.5 hours; including group work time)			
Introduction	Review objectives of Science Communication Lesson sequence.	3-4 minutes	Supporting File S2. Science Communication – Lecture Presentation Slides.
Ice breaker: Listen to an interview	Have students listen to one or two interviews or stories played for the whole class. Prompt students to think about how their reflection on what they heard can help inform how they make their own audio piece.	10 minutes	Use examples prepared before class. Suggested technique: think-pair-share; Supporting File S2. Science Communication – Lecture Presentation Slides.
Lesson 3 Objective	Introduce the objective of Lesson 3 - create an auditory product: an interview or a recorded story.	3-4 minutes	Supporting File S3. Science Communication – Example Video.
Audio communication and storytelling	Collaborative work: Students work in pre-arranged pairs to create a recorded interview or story.	75 minutes	Supporting File S2. Science Communication – Lecture Presentation Slides. Many students can record their auditory piece on their cell phones. Remind students that one-word answers do not make for a good interview—do not ask yes/no questions and do ask follow up questions!
Reporting back	*Optional: Have students sign up for Trint and transcribe their interview.	20 minutes	The transcribed interviews can be turned in and/or used to create a word cloud of student responses!
Share student work	Share each groups' audible product with the class.	20 minutes	If groups are producing their audio products digitally, have an online platform such as GoogleDrive or similar where students can upload work so you can have the whole class listen together.
Wrap up: Metacognitive assignment	Students complete metacognitive assignment about the importance of science communication and their reflections on the lessons.	10 minutes	See example Survey (Supporting File S4. Science Communication – Sample Metacognitive Exit Survey).