LESSON 7: What are ways we can communicate with people before and during a tsunami?

PREVIOUS LESSON *We read about how tsunamis are detected using a complex system of instruments and that tsunami warnings are only sent when specific criteria are met.*

THIS LESSON

INVESTIGATION

2 days

We listen to what a tsunami warning signal sounds like and notice and wonder about how people know what to do when they hear it. We read real accounts of tsunami survivors from Japan and what they did when the earthquake and tsunami occurred. We identify the stakeholders who the warning signal must work for, and then develop criteria and constraints for tsunami communication solutions. We evaluate different ways tsunami preparation and response are communicated to stakeholders, and also read a case study about a school in Kamaishi that included education as part of their plan. From this, we learn that there are many ways to communicate with community stakeholders before and during a tsunami event.

NEXT LESSON *We will develop a system model to represent what we've learned about detecting, warning people, and reducing damage from tsunamis. We will analyze the importance and purpose of the subsystems and generalize the process engineers use to develop systems and solutions to address a local hazard.*

BUILDING TOWARD NGSS

MS-ESS3-2, MS-ETS1-1, MS-ETS1-2

WHAT STUDENTS WILL DO

7.A Integrate stories and accounts of tsunami response with audio-visual tsunami warning and preparedness systems to determine the criteria and constraints of communication and education plan solutions for communities.

7.B Evaluate communication solutions using a systematic process and agreed-upon criteria and constraints to determine how well the design solution (structure) communicates with stakeholders (function).

WHAT STUDENTS WILL FIGURE OUT

- Groups of people can be affected by hazards in different ways depending on their access to 1) early warning information, 2) resources to protect themselves and property, and 3) ability to evacuate when necessary.
- Groups particularly at-risk during a hazard are older people, children, people who speak a different language, or those who are sick or require assistance.
- Effective plans account for the people living in a place and the resources communities need to respond appropriately.
- Communication strategies include educating the community before a natural hazard happens and alerting people when the hazard is happening.
- A variety of communication strategies (e.g., signs and symbols, warning sounds, multiple languages) are necessary to ensure that all people at risk understand how to respond quickly and safely in the event of a hazard.

Lesson 7 • Learning Plan Snapshot

Part	Duration	Summary	Slide	Materials
1	8 min	**WHEN AN WARNING SIGNAL IS SENT** Listen to real tsunami warning signals and notice and wonder about the next steps to respond.	A	https://www.teachersopensciedfieldtest.org/tsunami
2	8 min	**READ STORIES FROM JAPAN** Read quotes and stories from survivors of the Japanese tsunami about how they felt when the earthquake struck and tsunami warning signals were sent.	B	*Voices from Japan tsunami survivors*
3	12 min	**IDENTIFY COMMUNITY STAKEHOLDERS** Using stories from the community residents of Japan, students identify stakeholders and their needs.	B-C	*Voices from Japan tsunami survivors*, *Community Stakeholders*, chart paper, markers
4	12 min	**IDENTIFY CRITERIA AND CONSTRAINTS FOR COMMUNICATION SYSTEMS** Identify criteria and constraints for communication systems designed to warn people of a hazard.	D-F	*Community Stakeholders*
5	1 min	**HOME LEARNING** Assign home learning for students to notice all the ways they receive communication outside of school	G	
				End of day 1
6	10 min	**AGREE UPON CRITERIA AND CONSTRAINTS** Share criteria and constraints from day 1 and incorporate any new ideas that surfaced during the Home Learning.	H	*Evaluation Matrix*
7	15 min	**CASE STUDIES: COMMUNICATION OPTIONS** Evaluate different communication options and come to consensus on how well they meet agreed-upon criteria and constraints.	I-K	*Evaluation Matrix*, *Tsunami Communication Examples*, chart paper, markers
8	12 min	**CASE STUDY: KAMAISHI SCHOOL** Evaluate the value of having a preparedness plan in place when a natural hazard occurs.	L	*Reading: Kamaishi East Junior High School*
9	5 min	**UPDATE PROGRESS TRACKER** Update Progress Tracker to include new ideas.	M	
10	3 min	**NAVIGATION** Motivate the need to take stock in all the different systems to protect communities from tsunamis.	N	notecard
				End of day 2

Lesson 7 • Materials List

	per student	per group	per class
Lesson materials	• science notebook • *Voices from Japan tsunami survivors* • *Community Stakeholders* • *Evaluation Matrix* • *Tsunami Communication Examples* • *Reading: Kamaishi East Junior High School* • notecard		• https://www.teachersopensciedfieldtest.org/tsunami • chart paper • markers

Materials preparation (15 minutes)

Review teacher guide, slides, and teacher references or keys (if applicable).

Make copies of handouts and ensure sufficient copies of student references, readings, and procedures are available.

Make sure the audio can play for https://www.teachersopensciedfieldtest.org/tsunami .

Between day 1 and day 2, modify slide H to reflect student ideas that are generated on *Community Stakeholders*.

Be sure you have materials ready to add the following words to the Word Wall: stakeholder and system. Do not post these word(s) on the wall until after your class has developed a shared understanding of their meaning.

Lesson 7 • Where We Are Going and NOT Going

Where We Are Going

The focus of this lesson is helping students understand the communication and education systems in place to help people prepare and respond when a natural hazard is imminent. Preparing residents to respond is a critical aspect of saving lives and protecting communities. This preparation includes helping people recognize warning messages and sounds, to know when to shelter and when to evacuate, and where to go and how to get there calmly. The lesson supports students in thinking through the criteria and constraints associated with designing and evaluating communication and education plans for tsunamis and a local hazard in Lesson 9.

Where We Are NOT Going

Equity of access to resources and the ability to evacuate are very important issues for communities to address to have a fully effective plan. However, this lesson only focuses on a few groups with special needs (e.g., elderly, sick, children). If instructional time allows, addressing the complicated issues of ensuring access to resources during a natural hazard could be valuable.

LEARNING PLAN for LESSON 7

1 · WHEN AN WARNING SIGNAL IS SENT

8 min

MATERIALS: science notebook, https://www.teachersopensciedfieldtest.org/tsunami

ADDITIONAL GUIDANCE

Supporting emotions and empathy: This lesson integrates the alarm system sounds and the experiences and feelings tsunami survivors had as they received the warning signals of an approaching tsunami. The tales include grief at the loss of homes and people and feelings of being scared.

Students might experience similar emotions as they learn about how people responded in the tsunami event, and as they consider why education and communication solutions are key parts of a system designed to protect communities. Be prepared for students to struggle with fright or grief that comes with hearing or reading about natural hazard damage.

Prepare students for what they will hear. Display **slide A**. This lesson begins with an audio clip of Japan tsunami warning signals, including alerts from cell phones, TVs, loudspeaker announcers, and sirens. Say, *We are about to listen to what happens when a tsunami is detected and signals are received to warn people. We are going to listen to these sounds and think about what community residents might be feeling or hearing during these moments before a tsunami arrives. We will listen one time through without writing--just close your eyes and listen. The second time through, we will make notes about what we notice and wonder about. Consider as you listen: Who are the people hearing this? What will they do next?*

Play the audio clip at https://www.teachersopensciedfieldtest.org/tsunami . Ask students to close their eyes, put their heads down, and just listen to the alarm signals being sent to residents. The clip is 1:30 long. Once it has been played, ask students to take out their notebooks and as the clip is played a second time, ask students to record what they notice and wonder about in their science notebooks.

After the students have listened twice through the clip, say, *Remember, we just found out that when a tsunami is detected, and when scientists think it may reach land, they need to warn people. We just heard some of those warnings. What did you notice and wonder as you listened to the audio clip?*

Suggested prompt	Sample student response
What did you notice about the sounds we heard?	*The sounds were a little scary.* *They had lots of different sounds.* *I couldn't understand what the person was saying.* *It sounds like some were on cell phones, but others were loudspeakers.*

✱ ATTENDING TO EQUITY

Supporting empathy and emotions: Listening to sirens and alarming alerts can trigger a stress response in students. They are purposely designed that way to alert people to danger. However, it is important for students to experience the sounds they can expect to hear in a dangerous event, so that they can respond appropriately when they hear the sound. If students don't have experience hearing warning signals, they could become scared or panicked during the event. The Kamaishi case study on day 2 is a good example of how practicing listening to and responding to warning signals can help students be prepared in the event a natural hazard event occurs.

Support for Universal Design for Learning: Consider how some students may react to loud or alarming noises. If needed, the clip has lower tones starting at 1:08 through the end of the clip, where there is an announcer with very low sirens heard in the background. This section of the audio might be more appropriate to play for students who are sensitive to loud or alarming noises.

Suggested prompt	Sample student response
What do you wonder about?	*I am wondering how they know what the sound means.* *I wonder how they get the sound to people in all those different ways.* *I wonder about the people who don't have cell phones or can't hear.* *I wonder how they know what to do, especially if they don't speak the language.*

Acknowledge that alarm and warning signals can be scary.✱ Let students know these signals are often loud and scary, and that they are designed that way so that people are alerted to potential danger. Say, *It can be a scary thing to get a warning signal like that. Have you ever experienced that before?* Let students share their experiences to surface related phenomena, such as:

- tornado warnings on the TV
- Amber alerts on the phone
- fire/tornado/active shooter drills in the school

2 · READ STORIES FROM JAPAN

8 min

MATERIALS: *Voices from Japan tsunami survivors*

Transition students to consider accounts from the Japanese tsunami. Display **slide B.** Say, *On March 11, 2011 when the earthquake and tsunami struck Japan, the communities had to react to the warning signals. We have some stories from people who survived the tsunami about what they did and how they felt as it was happening.*

Divide students into partners. Each pair will read at least three accounts using *Voices from Japan tsunami survivors*. If time allows, they can read more. Ensure that pairs choose different accounts to read about so that all stories are read by one or more pairs of students in the classroom. As students read, ask them to pay close attention to:

- Who is this person?
- What was their experience like?
- What else would you like to know about their experience?✱

Let students read quietly for 3-5 minutes and then talk about these questions with their partner and be ready to share what they learned with the class.

Voices from Japan Tsunami Survivors

We wake up and see the sea, we talk about the sea...whether it is quiet or if it has waves, as we have always done together. When you live by the sea, you depend on it, and it is part of your life.

When we saw the water approaching, it flooded the national road as two trucks were passing. And then the water just kept coming.

Hiroko Sugarwara, grandmother

I thought, "The tsunami will come soon after the shaking stops. I must evacuate to the surrounding hills as quickly as I can. As soon as this idea entered my mind, my body reacted, thanks to the routine emergency drills that I had experienced before."

Kikuchi and her classmates fled from the school into the surrounding hills to escape the surging sea as a siren continuously wailed across the area. They ran for their lives along with the students of the adjacent elementary school, with whom they had conducted regular evacuation drills to ensure they survived an emergency together.

Kikuchi Nodoka, third-year student, Kamaishi Junior High School

My house was located just in front of the sea. I lived there for forty years. The sea was like our great mother. It was like our treasure. We have always received blessings from the sea...

We had a levee that was 5 meters (15 feet) tall that we thought could protect against a tsunami. And so we based all of our evacuation areas and exercises on this assumption.

Yuichi Owada, volunteer firefighter

"Nobuko Kikuchi, a 72 year-old resident of Iwanuma, Miyagi Prefecture, couldn't hear the emergency sirens that followed the 9.0 magnitude earthquake that struck on March 11, 2011. Nor could she hear the public announcement urging people to evacuate to higher ground as a massive tsunami was approaching the coast of northeastern Japan's Tohoku region. Kikuchi is deaf. She owes her life to a neighbor who came to alert her. Kikuchi narrowly escaped the monster wave, which uprooted and washed away her house."

When the earthquake hit, I had left my house and was driving. So I wasn't sure if it was an earthquake or just my car. But when I saw the way people were moving and the buildings shaking, I knew it was an earthquake.

I'm originally from an inland area, so I didn't have the common sense to know there was a danger of a tsunami when an earthquake happens...

When I got to the top of the hill and looked back at the city, it all looked different. There was so much water. It felt like it all happened in an instant.

Yu Muroga, medical salesman

operacircle.org

Page 1

✱ SUPPORTING STUDENTS IN ENGAGING IN OBTAINING, EVALUATING, AND COMMUNICATING INFORMATION

Use this text as an opportunity to support students in developing the element of: *Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.*

Throughout the lesson, students will draw on text, media, and visual displays to better understand the criteria and constraints for effective communication systems. At this point, students are drawing on qualitative information from survivor stories about how they responded.

3 · IDENTIFY COMMUNITY STAKEHOLDERS

12 min

MATERIALS: *Voices from Japan tsunami survivors*, *Community Stakeholders*, chart paper, markers

Identify characteristics of community members from the stories. Continue to display **slide B**. Ask partners to share stories from *Voices from Japan tsunami survivors* with the class. Use the questions on the slides to help focus students' sharing with the whole class.

Suggested prompt	Sample student response
Who is this person?	*A grandmother.* *A student.* *A teacher.* *A business owner.*
What was their experience like?	*She saw water coming and it just kept coming.* *The student knew that a tsunami was coming and planned to go to the hills as soon as the shaking stopped.* *She couldn't understand the announcements.* *He knew they needed to evacuate right away.*
What else would you like to know about their experience?	*I'm wondering if the grandma was safe where she was on the hill.* *I'm wondering how the students knew what to do.* *I'm wondering if the teacher was able to figure out what the announcement meant.* *I'm wondering if the business owner and his employees made it to safety.*

Define stakeholders. Say, *It sounds like most of these people either knew what was happening, or someone warned them, but there were some people that didn't quite know what was happening. They all survived the tsunami in Japan, but they had different experiences based on who they are and what they knew about tsunamis.*

Take a moment with students to define "stakeholders" for students. First, ask students, *As we work together to figure out ways to protect and warn communities about tsunamis, what from these first hand accounts might help us in evaluating different solutions?* Let students share some ideas, such as how the designs need to work for all people in the community.

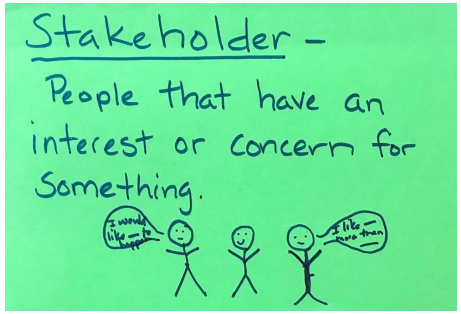
Say something like, *Engineers who design solutions, such as seawalls and communication systems, want to make sure solutions work for all the people affected. These people are called "stakeholders" because they all have a "stake" in what design solutions might work best for them and their community. And some stakeholders have certain needs while others need something else.*

Add "stakeholders" to the Word Wall.✱

✱ ATTENDING TO EQUITY

Supporting Emergent Multilinguals: Teachers can support all students, particularly emerging multilingual students, in forming a deeper understanding of newly "earned" vocabulary by representing the new term in multiple ways. For example, students can 1) write the term, 2) draw a representation of the term, 3) use their own words to write an explanation for what the term means, or 4) use the new term in a sentence.

The representation for stakeholders (people who have an interest or concern or investment in something) should mostly illustrate the people who will be impacted by the design solution (in this case, a warning system that communicates to people how and when to respond).



Identify stakeholders for tsunami warning signals. Display **slide C** and distribute *Community Stakeholders*. In partners, using Part 1 on the handout, have students identify individuals or groups of people that are represented by the stories they read about. Challenge students to think about any special assistance the stakeholders might need during an emergency. Give partners about five minutes to work on this.

Share stakeholders as a class. Bring students back together to share their list of stakeholders and needs as a class. Title a t-chart with "Stakeholders" on the left column and "Assistance?" on the right column. Allow partners to share their ideas. To avoid duplicate ideas, use questions like:

- Did anyone else identify that stakeholder group?
- Did you have the same needs?
- Would you add something to what _____ already identified?

Identify special needs for consideration. Once you have generated a list of stakeholders and their needs, ask students: *Are there individuals or groups that have special considerations that we should think about? Are there groups of people we haven't identified? For example, are there groups of people in the community that might have trouble evacuating quickly?*

Who is this community member? Stakeholders	Will they need special assistance in an emergency?	Describe their needs.	Who can assist them?
Business owner	☐ yes ☒ no		
grandmother	☒ yes ☐ no	help evacuating to high ground	family, neighbors
young student	☒ yes ☐ no	help knowing where to go	teachers Older students
Salesman	☐ yes ☒ no		

Add a star to those stakeholders to identify them as a higher at-risk group during an evacuation and note the reason using a different color marker. Examples include:

- Younger children (might not know where to go or how to get there; cannot drive).
- People who are not might not be able to evacuate quickly (elderly or ill people may not be able to move quickly enough for an evacuation; may not be strong enough to climb onto objects).
- People who don't have technology (they may not see or hear the signal).
- People who are traveling and do not know the area and/or local language (they won't know where to go or might not be able to interpret the language).

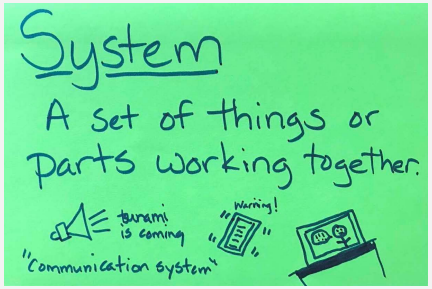
Transition students to now consider what a communication system needs to do to protect the most people. Say, *Now that we know who needs to know a tsunami is coming, let's consider what communication solutions we need to protect as many people as possible.*

4 · IDENTIFY CRITERIA AND CONSTRAINTS FOR COMMUNICATION SYSTEMS

12 min

MATERIALS: *Community Stakeholders*

Identify the potential problems and goals of an effective communication system. Display **slide D**. Using Part 2 of *Community Stakeholders* have students consider what design problem engineers are trying to address when they put together communication plans for natural hazards and also the goals of an effective system. It might be helpful to frame these two questions in this way:



- What is the problem that engineers are trying to solve when they develop hazard communication systems?
- What would that system need to be able to do to address the community stakeholders' needs?

Pause here to discuss the use of the word "system." Students have used this word before in previous units, but it takes on a new meaning at this point when referring to hazard communication systems. Ask students to come to a shared understanding of how the word "system" is being used. An example might be: A

system is a set of parts that work together to perform a particular function/job. And sometimes larger systems have smaller sub-systems that work together. In this case, a hazard communication system includes ways to both alert people to what is happening and also help them respond in the safest possible way. Add "system" to Word Wall.

Let students discuss with a partner the answers to the questions for a few minutes. Then, ask students to share with the whole class.

Suggested prompt	Sample student response
What is the problem that engineers are trying to solve when they develop hazard communication systems?	*They are trying to save as many people as they can.* *They are trying to make sure as many people know what to do as possible.*
What would that system need to do to address all the needs of the community stakeholders?	*It would need to have different ways of communicating with different groups of people.* *It would need to reach the largest number of people possible.* *People would need to know what to do before the tsunami happens too.*

Define criteria and constraints for the communication system. Say, *OK, now that we have an idea of what the problem is and the goals of the system, let's figure out what the system has to do to work and what considerations we need to think about as well. Let's think about one criteria and one constraint together, and then you and your partner can brainstorm the rest.*

Display **slide E**. Together, brainstorm one possible criteria for a communication system. For example:

Identify Criteria What *must* the system be able to do to be effective?	Why is this an important criteria?
It must reach as many community members as possible.	By alerting as many people as possible, we can save more lives.

Then, brainstorm one possible constraint for a communication system. For example:

Identify Constraints What might limit the system that is put into place?	Why is this constraint important to consider? Is there a particular stakeholder group that we should consider?
The communication of the warning signal should include multiple modes of communication (audio, visual, and haptic warnings). The technology used for the warning signals should reach all areas within the community.	By having different modes of communication, it is more likely to reach a larger group of people, including those people who need additional audio, visual, or vibration options. Community members who are not able to hear, see, or feel the signals will be in more danger.

To help facilitate student thinking about possible criteria for a system or constraints, display **slide F**. This slide provides students with ideas for what might be a criteria or a constraint for communication. However, it is fine for students to think outside of this list. Below are some possible ideas that might emerge from the students' brainstorm.

Question to consider from handout	Criteria and Constraints that students might identify (these may also include limitations on the technology itself)
Who gets alerted?	**Possible Criteria:** All people in the affected area are notified of the hazard. **Possible Constraints:** Georeferenced alerts are sent to all cell phone users within the tsunami zone, but users might opt-out of alerts, or those without cell phones might not receive an alert.
What media options should be available to send a signal?	**Possible Criteria**: Offer as many ways to hear, see, or feel a warning signal. **Possible Constraint:** Warning signal should use at least 3 different forms of media, such as cell phone alerts, sirens, and TV announcements. But there are limitations on the technology: some people do not use media; distance from a siren might be too great to hear.
Can all people hear, see, or feel some kind of warning signal or alert?	**Possible Criteria**: Communication systems must include a warning signal that can be seen, heard, and felt (haptic) to reach as many people as possible. **Possible Constraint:** Some people have limited access to media and may not receive the signal.
What languages or symbols should be used in this kind of system?	**Possible Criteria**: At least two widely spoken languages are used in the announcements; recognizable symbols clearly mark evacuation routes. **Possible Constraint:** Visitors may not speak or read either of the two widely used languages in the region. Also, the symbols used in a particular region may be culturally relevant and therefore unrecognizable as visitors to a region may not recognize the same symbols or may interpret their meaning differently.
What does the message need to say to warn people?	**Possible Criteria**: Communicates warning in everyday language so people understand. **Possible Constraint:** All world languages cannot be **communicated** at once--some subgroups may be left out. Signals may take too long to transmit to a different language (maybe there is a loop time for messages). If only audio, those with hearing issues would not be alerted and if only visual, those with vision **impairments** might struggle.
What are the evacuation routes and places for people to shelter? How are these routes marked?	**Possible Criteria**: Evacuation routes are well-marked with signs that have words and symbols. **Possible Constraint:** Some may not understand the signage, or know where to look for it if from out of the area.
How will people know what to do when the warning signal goes off?	**Possible Criteria**: Education programs, pamphlets, maps, and signs are used to spread the message of what to do. **Possible Constraint:** Formal educational systems may not be available to all populations in a tsunami-prone region**.**

Gather student handouts and use the students' brainstormed criteria and constraints to pose a list of them for the evaluation process on day 2, using **slide H**. Choose around 3 criteria from the class set of ideas to add to the slide in preparation for day 2.

ASSESSMENT OPPORTUNITY	**Building towards: 7.A** Integrate stories and accounts of tsunami response with audio-visual tsunami warning and preparedness systems to determine the criteria and constraints of a communication and education plan for communities. **What to look for/listen for:** Look for clearly identified stakeholders with particular needs for emergency communication, and then corresponding criteria and constraints that address those needs, but might limit what can be used to develop or evaluate potential solutions. Use the example table above to see specific example student responses. **What to do:** Scan the student responses and find at least three criteria that will be used to consider communication options on day 2. Choose criteria that might be focused on the type or amount of text, language of text, clearness of symbols, and the use of multi-modes of communication (e.g., combinating symbols with text).

5 · HOME LEARNING

1 min

MATERIALS: None

Assign Home Learning. Display **slide G**. Say, *As you experience communication outside the classroom between now and the next class, pay attention to all the ways you send and receive communication. Think about whether there are any ideas from your experience that we should consider.*

End of day 1

6 · AGREE UPON CRITERIA AND CONSTRAINTS

10 min

MATERIALS: *Evaluation Matrix*

Share a list of criteria and constraints. Introduce a shared set of criteria and constraints from student ideas developed at the end of day 1. Say, *I looked through your ideas from our handout where you brainstormed possible criteria and constraints. I condensed the list for us to use for our work today. Take a look and see if I left off something that we should include.*

Display **slide H**. Give students a moment to look through the list of criteria chosen from their work on day 1. Then ask students if they have any clarifying questions or criteria to add that were not captured.

Add any new ideas from Home Learning. Remind students of their home learning assignment and ask them if they noticed any new information we should consider regarding ways we send or receive communication. Ideas that might surface include:

- Visual communication: billboards, signs, TV ads
- Audio communication: streaming radio or music channels, alerts on phones or smartwatches, smart home devices, radio, loudspeakers, announcement systems
- Haptic communication (this might not come up): touch or tapping feelings from devices such as smart watches, tablets, cell phones

As students share, ask them to see if their new ideas about how they communicate are represented already on the list on **slide H**, or if they want to add something that is missing.

Pass out *Evaluation Matrix*. Ask students to record the criteria and constraints or limitations from the slide onto the first row of the matrix on the handout so they are ready to evaluate different communication systems.

7 · CASE STUDIES: COMMUNICATION OPTIONS

15 min

MATERIALS: *Evaluation Matrix*, *Tsunami Communication Examples*, chart paper, markers

Evaluate different communication options using criteria and constraints. Display **slide I.** Divide the class into 10 groups of students (2-3 per group). There are five different communication options that will be evaluated using a Jigsaw method. Students will use the communication options in the student edition under *Tsunami Communication Examples*.

- Groups 1 & 2: Educational Flyer from US NOAA
- Groups 3 & 4: Pocket Pamphlet from Japan
- Groups 5 & 6: Graphic Flyer from Indonesia
- Groups 7 & 8: 1st cell phone app from Japan
- Groups 9 & 10: 2nd cell phone app from Japan

Groups will work separately at first to review the resource and rate it against the criteria. Groups will also list possible community constraints that might limit how the solutions could work for the community, or students might even list constraints of the technology itself. Give students 5 minutes to do this initial pass. They will rate only the options on their assigned row.

Display **slide J** with new instructions. The two groups assigned to the same communication options will need to meet together and come to consensus on how they rated the option, and what constraints the communication option might have.✱

Share ratings across groups. Once groups have shared agreement on their assigned communication option, reconvene the class to share the results. Title a chart as "Communication Options" (or project a blank *Evaluation Matrix* onto a whiteboard). Ask the groups to share their ratings and record their thinking for the class.

Ask students if they notice any patterns in the ratings, and whether they think one option is better than the others. For example, ask, *Does one of these options seem to do everything really well? Why or why not?*

Evaluation Matrix

Evaluating the solution against our criteria and constraints.

Use the following rating scale to consider how well the communication system performs:

- ●●●●● Performs really well
- ●●● Performs well
- ● Does not perform well or is absent

Communication System Solution	Criteria 1 Reach all people	Criteria 2 Use everyday language	Criteria 3 Help people respond	List possible constraints
Educational Flyer from US NOAA	●●●	●●●	●●●●●	Uses limited language; requires lot of reading, only 1 form of interaction
Pocket Pamphlet from Japan	●●●●●	●●●	●●●●●	Small text; only one form of interaction
Graphic Flyer from Indonesia	●●●●●	●●●●●	●●●●●	only seen where posted Small text → difficult to read.
1st cell phone app from Japan	●●●	●●●	●●●●●	community might not have access Requires technical understand
2nd cell phone app from Japan	●●●	●●●●●	●●●●●	Community members might not have cell/app range

ASSESSMENT OPPORTUNITY

Building towards: 7.B Evaluate communication options using a systematic process and agreed-upon criteria and constraints to determine how well the design (structure) serves to communicate to stakeholders (function).

What to look for/listen for: Listen for agreement within the jigsaw groups about what their assigned communication option does well and what are its limitations. Then, across all groups, as a whole class, listen for ideas about how some communication options meet some criteria very well, while others meet other criteria well. The purpose of this work is to better understand that by combining multiple forms of communication, systems can address multiple stakeholder needs.

What to do: If students struggle to come to agreement within the group, ask students, *Does that fit the criteria we laid out? How do you know?* Or, *Does it fit some criteria well, but not others?* When combining work across the groups, encourage students to consider patterns in what they are noticing, such as, *Which of these options does ____ well? Which of these options does not do _____ well?*

✱ SUPPORTING STUDENTS IN ENGAGING IN ARGUMENT FROM EVIDENCE

As groups engage in this discussion, center their focus on how their evidence can be useful for evaluating claims and persuading others about the validity of their ideas. When students are engaged in the work of argumentation, they should explicitly build from evidence, past experiences, and/or shared observations to support their conclusions.

Discuss the benefits of having multiple options available. Come back together as a whole class and pose this question using **slide K**: *Why would it be important to have multiple modes of communication in the event of a hazard?*

Suggested prompt	Sample student response
Why would it be important to have multiple modes of communication in the event of a hazard?	*To reach the largest number of people.* *To have a backup in case one thing fails.*

Transition to the next reading. Say, *We have great communication options and they do some things well and other things not as well. Having multiple options in place provides a back up, especially when one thing fails. We are going to read about some students' experiences during the tsunami when their warning system broke, and we are going to see what back up plan they had in place.*

8 · CASE STUDY: KAMAISHI SCHOOL

12 min

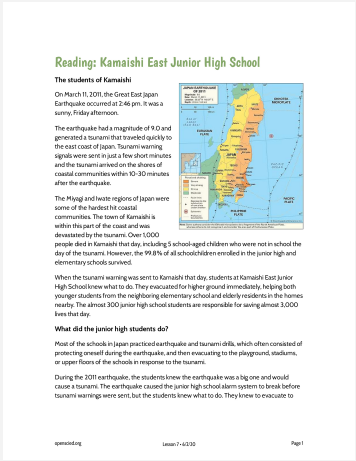
MATERIALS: *Reading: Kamaishi East Junior High School*

Introduce students to the Kamaishi Junior High School. Display **slide L**. Say, *We know that having multiple options in place is a good idea so that we can reach as many people as possible, and also in case something fails. Let's see how some kids dealt with this same situation.*

Have students first read and mark up a copy of *Reading: Kamaishi East Junior High School*. There is a full color version of the story in the student edition. As they read, have students consider:

- What communication plans did this school have in place?
- What worked well or didn't work well?
- Is there anything about this case that we haven't thought of yet?

Give students 5-8 minutes to read about Kamaishi. Then, reconvene the whole class to discuss the Kamaishi experience.



Reading: Kamaishi East Junior High School

The students of Kamaishi

On March 11, 2011, the Great East Japan Earthquake occurred at 2:46 pm. It was a sunny, Friday afternoon.

The earthquake had a magnitude of 9.0 and generated a tsunami that traveled quickly to the east coast of Japan. Tsunami warning signals were sent in just a few short minutes and the tsunami arrived on the shores of coastal communities within 10-30 minutes after the earthquake.

The Miyagi and Iwate regions of Japan were some of the hardest hit coastal communities. The town of Kamaishi is within this part of the coast and was devastated by the tsunami. Over 1,000 people died in Kamaishi that day, including 5 school-aged children who were not in school the day of the tsunami. However, the 99.8% of all schoolchildren enrolled in the junior high and elementary schools survived.

When the tsunami warning was sent to Kamaishi that day, students at Kamaishi East Junior High School knew what to do. They evacuated for higher ground immediately, helping both younger students from the neighboring elementary school and elderly residents in the homes nearby. The almost 300 junior high school students are responsible for saving almost 3,000 lives that day.

What did the junior high students do?

Most of the schools in Japan practiced earthquake and tsunami drills, which often consisted of protecting oneself during the earthquake, and then evacuating to the playground, stadiums, or upper floors of the schools in response to the tsunami.

During the 2011 earthquake, the students knew the earthquake was a big one and would cause a tsunami. The earthquake caused the junior high school alarm system to break before tsunami warnings were sent, but the students knew what to do. They knew to evacuate to

openoced.org Lesson 7 • 6/2/20 Page 1

Suggested prompt	Sample student response
What communication plans did this school have in place?	*They had an announcement system.* *They knew where to evacuate.*
What worked well or didn't work well?	*The announcement system broke so that didn't work well. But then the kids started shouting to each other and helped the younger kids and some elderly people too.* *They knew they needed to evacuate quickly and help others, so that is what they did.*

Suggested prompt	Sample student response
Is there anything about this case that we haven't thought of yet?	*They worked with an expert beforehand to know what to do.*

Highlight the importance of knowing how to respond in a hazard. Say, *It looks like the students in Kamaishi were still able to remain safe, even when one part of the system designed to protect them failed! Some of the ideas you mentioned about how they stayed safe made it sound like they had a plan for what to do if a tsunami warning sounded.*

Suggested prompt	Sample student response
How could having a plan help in the event of a natural hazard?	*We've seen things break when hazards happen so you need to know how to protect yourself when that might happen.* *They happen suddenly and sometimes you might not know what to do, so having a plan ahead of time makes it easy to do the right thing when you need to.*

9 · UPDATE PROGRESS TRACKER

5 min

MATERIALS: science notebook

Update Progress Tracker. Display **slide M**. Ask students to turn to the Progress Tracker section of their science notebooks. Ask students to create a new row on the three column tracker and give them time to record what ideas they figured out and how they can now apply these new ideas. Give students about 5-8 minutes to do this.

Question	What we figured out	How can we apply our ideas to protect communities?
How can communities respond and prepare for tsunamis?	*To protect more people, a tsunami warning must reach and be understood by as many people as possible and very quickly so that they can respond quickly.* *It's also important that the community is prepared before a natural hazard occurs and that they know where to evacuate.*	*Using sounds, recognizable symbols, and languages in all communications is critical; have alternatives for people with special needs.* *Education, school drills, neighbors know who may require assistance.*

10 · NAVIGATION

3 min

MATERIALS: notecard

Motivate the reason to take stock of ideas. Say, *It looks like many coastal regions in Japan use more than one of these systems simultaneously. For example, Ryoishi had a seawall and warning system, and so did Kamaishi. It had breakwaters, sirens, and the schools did disaster education training. I wonder what it looks like when all these systems are put together? How do you think they work together?*

Display **slide N**. Give each student a notecard and give them a few minutes to consider:

- How do all these systems work together to protect communities from tsunamis?

Additional Lesson 7 Teacher Guidance

SUPPORTING STUDENTS IN MAKING CONNECTIONS IN ELA

The texts in this lesson supports students in developing the following reading standards:

- CCSS.ELA-LITERACY.RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts.
- CCSS.ELA-LITERACY.RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.
- CCSS.ELA-LITERACY.RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).