Global Climate Change -
How can we model solutions for climate change?

YOUR NAME: Ashley Shunk

LESSON TITLE: Zoom in on Solutions: Climate Change Action

RECOMMENDED GRADES- 7th-12th Grade

TIME NEEDED: 4-6 hours.

OBJECTIVES:
● SWBAT create open-ended questions about climate change.
● SWBAT design an initial model of climate change and produce a revision of the model at the end of the lesson.
● SWBAT research different careers involved in climate change solutions.
● SWBAT collaborate with their classmates to create a map of the areas most affected by climate change around the world.
● SWBAT collaborate with their classmates to create a map of solutions based on the amount of carbon emissions in that region.
● SWBAT create a podcast detailing the implementation of a solution in a given region.
● SWBAT evaluate the effectiveness of models.

MATERIALS:
Print handouts attached.
Blank paper for models and markers
Internet and computers/tablets/phones (optional if you print screenshots/packets of information about different region’s major emissions and solutions to climate change)
Recording Device (computer, phone, camera)

PREPARATION:
Print out the handout.
Projection or print of map on the board for students in ACTIVITY 8.
Emissions by Region and Category packets of information ACTIVITY 8 or students can research
Data sets or packets of information for a case study on solutions of climate change ACTIVITY 9 (modification) or students can research.
Prepare links for students online to be able to click on them easily. Upload this document or send it to their email.

DIRECTIONS:
Activity 1: Initial Model (5 minutes)
Individually, students will receive a small map. On the map they need to circle the areas of the world that they believe are most affected by climate change. They should write on the notes section why they selected that area. Students will write open-ended questions that they have about climate change and share those questions on the board.

Activity 2: Reading (10 minutes)
In pairs, students will read part of this article: https://www.un.org/en/chronicle/article/climate-change-around-world-view-un-regional-commissions They will annotate the article looking for main ideas, important points and interesting facts.
Activity 3: Model Revision #1 (15 minutes)
Students will draw a model of climate change effects around the world using the provided legend. Students share their model with a classmate. What are the similarities and differences between the classmate’s models?

Activity 4: Research a Model (20 minutes)
Students will use this website to compare their answers: https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world Students should be prompted to think about if anything surprises them on the model.

Activity 5: Research (10 minutes)
The students watch this video: https://www.youtube.com/watch?v=3PIEIn1_iXo While watching the video they draw EVERYTHING that they see in the video. The video should be paused at least twice during the video.

The students watch this video: https://www.youtube.com/watch?v=ELYZWXzEq5o While watching the video they draw EVERYTHING that they see in the video. The video should be paused at least twice during the video.

Activity 6: Evaluate Models (15 minutes)
Students will evaluate the model and website model of climate change effects by using the two pluses and a minus chart for each model. Prompt students to think about the limitations of the model on the website. Was every effect of climate change included? Is the website up to date? What was included or left out?

Activity 7: Discussion- Hypothesis (15 minutes)
Prompt students to answer this question: Compare two years of events using the website, what is your analysis? Ask students to think-pair-share and then call on a few students to share their ideas. Ask students to predict what next year’s map will look like. Students will write down their prediction.

Activity 8: Model Revision #2 (20 minutes)
Provide students a list of solutions from the Climate Action Project: https://www.climate-action.info/list-solutions Prompt students to create a new map with solutions for climate change. The students will each choose 3 solutions and research which country/city/state would most impact the global carbon footprint by implementing that solution. They will draw the solution on the class map on the area that should act on that solution.

Activity 9: Research (30 minutes)
Students will choose one solution, research the cost of the program, careers involved and the details of implementing the program. This would include any graphs or charts or information that explains how much CO2 will be reduced from the implementation of the solution. Prompt students to consider if this solution is also useful in the local community.

Activity 10: Creating (15 minutes)
The students will find one organization/company/government leader that could help with the implementation of that solution and send that organization a 1 minute podcast detailing the implementation of that solution. Here is one option to record: https://online-voice-recorder.com/
Activity 11: Wrap Up (10 minutes) - Model Revision #3 Students should be prompted to answer this question:
Is there anything else that we should add on this model after everything that we have discovered?

PRIOR SKILLS & UNDERSTANDINGS NEEDED:
- Knowledge of annotation during reading
- Research skills
- Basic knowledge of recording a podcast.
- Understanding causes of climate change

MODIFICATIONS:
- In a low-tech classroom, the website maps images could be screenshot and printed or projected on the board.
- Some students may not want to perform a podcast. Another option for their final product could be a written assignment or video.
- ACTIVITY 8 MODIFICATION: Students could be provided infographics and packets of information for different regions/countries major causes of CO2 emissions.
- Teacher could choose a solution from the class list and the class could create the podcast together.
- ACTIVITY 9 MODIFICATION: Students could be presented with a case study of four different solutions. The case study will include all of the information that they need to complete the project. The students could have a discussion with the teacher using guiding questions. They could chart the information on the board as a class. The students could use that information to decide which is the best solution.

<table>
<thead>
<tr>
<th>Solution 1</th>
<th>Solution 2</th>
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Based on your discussion with your class, what do you think is the best solution? Explain completely.

EXTENSIONS:
Students return to the website the following year and see if their predictions were correct.

Students study Goal #13 from the United Nations Sustainable Development goals and choose an article to evaluate one solution from the website:
**VOCABULARY:**
- CO2 Emissions
- Increase/decrease
- Region
- Population
- Projected
- Losses
- Species
- Quantitative data
- Mitigate
- Latitude/longitude
- Habitat
- Urbanization
- Industrialization
- Economics
- Deterioration
- Polar
- Sea-level rise
- Permafrost

**ASSESSMENT:**
Students will complete the worksheet that is included. There is also a checklist. Evaluate students on the progress of their models as well.

<table>
<thead>
<tr>
<th></th>
<th>Initial Model #1 Activity 1</th>
<th>Revision #2 Activity 3, 4, 6</th>
<th>Revision #2 Activity 8</th>
<th>Revision #3 11</th>
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<td>Recognizes a local connection to solutions for climate change</td>
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This assessment is formative, but could easily be modified to be summative.

**RESOURCES:**
### Zoom in on Solutions: Climate Change Action

You are a contracted innovator for the United Nations. They expect you to locate areas in the world producing a lot of CO2 emissions and design solutions that will reduce emissions. This is urgent and the podcast that you create will need to be sent this week or else more CO2 emissions will continue to accumulate. Who will take responsibility for the CO2 emissions and which solutions are the best?

We will use modelling throughout the lesson. This is a formative assessment and will help us to see your progress throughout the lesson!

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Activity 1 - Initial Model

<table>
<thead>
<tr>
<th>Circle the area(s) of the map that you think are most effected by climate change.</th>
<th>Explain why you circled that region.</th>
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<tbody>
<tr>
<td></td>
<td>What open-ended questions do you have about climate change?</td>
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Activity 2
Read this section and annotate main ideas, important points, unknown vocabulary and interesting facts. Use these symbols to guide your active reading:


### Africa
- By 2020, between 75 million and 250 million people are projected to be exposed to an increase in water stress due to climate change.
- Agricultural production, including access to food, is projected to be severely compromised by climate variability and change. This would further adversely affect food security and exacerbate malnutrition in the continent.
- In some African countries, yields from rain-fed agriculture could be reduced by up to 50 per cent by 2020.
- Toward the end of the twenty-first century, projected sea-level rise will affect low-lying coastal areas with large populations.

### Asia
- Freshwater availability in Central, South, East and Southeast Asia, particularly in large river basins, is projected to decrease due to climate change, which could affect more than a billion people by the 2050s.
- Coastal areas, especially the heavily-populated mega-delta regions in South, East and Southeast Asia, will be at greatest risk due to increased flooding from the sea and rivers.
- Climate change is projected to impinge on sustainable development of most developing countries of Asia, with the region’s rapid urbanization, industrialization and economic development.

### Australia and New Zealand
- Significant loss of biodiversity is projected to occur by 2020 in some ecologically rich sites, including the Great Barrier Reef and Queensland Wet Tropics.
• Production from agriculture and forestry by 2030 is projected to decline over much of southern and eastern Australia and over parts of eastern New Zealand due to increased drought and fire.

Europe
• In Southern Europe, climate change is projected to worsen conditions due to reduced water availability, hydropower potential, summer tourism and crop productivity.
• Mountain areas will face glacier retreat, reduced snow cover, winter tourism and extensive species losses.
• In Central and Eastern Europe, summer precipitation is projected to decrease, causing higher water stress.

Latin America
• There is a risk of significant biodiversity loss in many areas of tropical Latin America.
• In drier areas, climate change is expected to lead to salinization and desertification of agriculture lands.
• Sea-level rise is projected to cause increased risk of flooding in low-lying areas.

North America
• Warming in western mountain ranges is projected to cause decreased snowpack, more winter flooding and reduced summer flows.
• Cities that currently experience heatwaves are expected to be further challenged by an increased number, intensity and duration of heatwaves.
• Coastal communities and habitats will be increasingly stressed by climate change impacts interacting with development and pollution.

Polar Regions
• In the Arctic, additional impacts include reductions in the extent of sea ice and permafrost, increased coastal erosion and increased depth of permafrost seasonal thawing.
• In both polar regions, specific ecosystems and habitats are projected to be vulnerable, as climatic barriers to species invasions are lowered.

Small Islands
• Small islands, whether located in the tropics or higher latitudes, have characteristics that make them especially vulnerable to the effects of climate change, sea-level rise and extreme events.
• Climate change is projected by the mid-century to reduce water resources in many small islands, such as the Caribbean and the Pacific.
• Deterioration in coastal conditions through erosion of beaches and coral bleaching is expected to affect local resources.

Activity 3:
Use the following map to create a model about which areas are effected by climate change. Draw these symbols on the map in the locations that will be most effected. You can use a symbol more than once.
How was your classmate’s model different from your own model?

Activity 4: Compare your answers with the website model. Were you surprised by anything on the website?
Activity 5:
Video 1-

Video 2
Activity 6:

<table>
<thead>
<tr>
<th>My Model</th>
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<tbody>
<tr>
<td>Two Positives About My Model</td>
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<table>
<thead>
<tr>
<th>Website Model</th>
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<td>Two Positives Website Model</td>
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</table>

Activity 7: Discussion. Write your hypothesis here.
What do you think next year’s map will look like?

Activity 8:
Which solutions will you research? [https://www.climate-action.info/list-solutions](https://www.climate-action.info/list-solutions)

<table>
<thead>
<tr>
<th>Solution</th>
<th>Country that Needs to Do This Solution, because they create a lot of CO2 emissions without it.</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
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</table>
Document the classes’ ideas for solutions on the map below.

Activity 9:
Which solution will you research?

How does the solution work?

What type of professional skills are needed to implement the solution? Careers?

How much do you think the solution would cost to implement?

What quantitative data can you share about how much CO2 emissions this solution could mitigate/reduce?
Would this solution also be helpful in your own community? Why or why not?

Activity 10:
Which organization/company/government leader/university would be able to assist with the implementation of your solution? List contact information if you find that.

Record your podcast. [https://online-voice-recorder.com/](https://online-voice-recorder.com/)

**Checklist for Podcast**

<table>
<thead>
<tr>
<th>Requirement</th>
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<tbody>
<tr>
<td>One solution identified</td>
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<tr>
<td>Solution is explained</td>
</tr>
<tr>
<td>Types of professional skills needed/careers involved</td>
</tr>
<tr>
<td>Cost of solution</td>
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<tr>
<td>Quantitative data on emissions mitigated</td>
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<tr>
<td>Discussion of local impact of the solution</td>
</tr>
<tr>
<td>Organization/company/government leader/university selected</td>
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<tr>
<td>Send your podcast.</td>
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Activity 11: Model Revision #3
Is there anything else that we should add to this model after our discoveries?

Should we add this solution to our own region?

Do we know anyone in the local community that would like to implement this solution?