The Greenhouse Effect for Fifth and Sixth Grade

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Grade Level: Elementary, 5th and 6th Grade

Summary

The idea behind this classroom project came from the movie Carbon Nation. The first couple of minutes that contained the cartoon about the carbon dioxide video were the focus for this activity on the greenhouse effect and the introduction to the unit. Viewing the film Carbon Nation gives an important perspective to the issue of global climate change that can be passed on to the students. Prior to the viewing of segments of the film and this activity students had to write any and all information about what they knew concerning global warming and the greenhouse effect.

Objectives

1. Get students to understand the concept of global warming.

2. Help students to identify ways that could help slow down global warming during their lifetime.

3. Students will build their own basic model of earth landforms and ocean surfaces to describe localized warming effects and overall global warming effects.

Materials

a 16 inch by 16 inch pizza box

construction paper

a piece of clear plastic wrap to cover the box

a thermometer.

Students work in pairs to build a thermo generator based on what they believe the current surface of the earth looks like.

Results range from very detailed to extremely minimalist. It is interesting to see what students perceive the earth's surface looks like using just simple material as provided for in this lab.

From the very start, regarding this entire unit, continually emphasize the effects the students can have on local/personal level regarding global warming. They will get the overall idea but to

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understand the relevance at their level is something that will take continued teacher support and should be the main teacher task during the activity.

Science Standards

The overall concept of the entire unit is that global warming is having an effect and many of those effects are due to humans. The following Nevada state science standards are addressed:

N5A: Students understand that science involves asking and answering questions and comparing answers to what scientists know about the world.

N5A1: Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method.

N8A3: Students know how to draw conclusions from scientific evidence.

N5A4: Students know graphic representations of recorded data can be used to make predictions.

N5A5: Students know how to plan and conduct a safe and simple investigation.

N5A6: Students know models are tools for learning about the things they are meant to resemble.

N5B3: Students know the benefits of working with a team and sharing findings.

L5C3: Students know changes to an environment can be beneficial or detrimental to different organisms.

Using the Inquiry Cycle

Begin the inquiry cycle by discussing, "What question are we really trying to answer?" and "What is a theory?" and "How can we model the earth's surface?"

Take some time to get the students to understand the difference between hypothesis, theory, and law, perhaps even taking a day prior to the activity to teach these concepts.

Inspire discussion to help the students to come up with the question of "How does the color of paper affect the temperature of a space?" to make sure the students are on the right path.

Divide the class into groups of students, 5-6 per group and have them come up with a hypothesis to this question.

The answers will range from "No change" to "Our hypothesis is that the temperature will vary depending on the color of the paper used", possibly even as insightful as, "The darker the paper,

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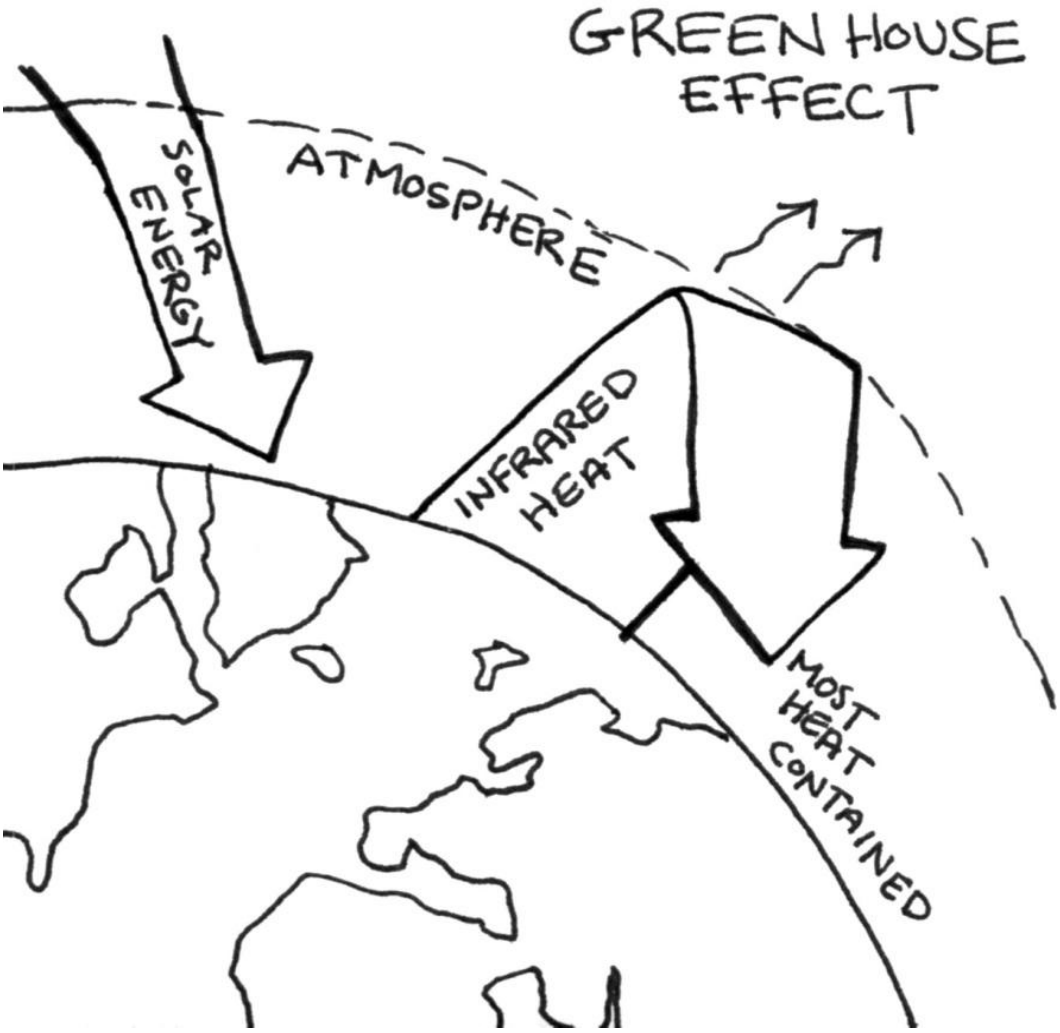
the hotter the box will get since it will absorb the sunlight" and "The lighter colors will reflect light and so will be cooler."

Have students continue to discuss the process by which light affects overall and surface temperatures and how they could find a way to measure a change. Make a list of these on the board or easel paper.



Write all the possible hypotheses on the board and have the students vote as to what they think will happen based on the class' ideas.

Wrap up this part of the lesson by discussing whether all hypotheses could be right and end with asking them how we can prove which one of the hypotheses is correct. Hint at the idea that some

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of the hypotheses are wrong, but do so with the ultimate nature of science in mind, i.e., that science requires a question first and then testing to see if the hypothesis is correct or not.

Testing the Hypotheses

In the next class session have student pair up and hand out a 16 inch by 16 inch by 2 inch pizza box with the top of it removed.

Give only minimal directions like this:

"Build what you believe is a model of the earth's surface using only construction paper."

Do your best to answer as few questions as possible, rather referring them to the globes or atlases or maps that have been provided around the classroom and give no further details.

Give them 30 minutes to complete the activity in class, using only construction paper and tape for this first try.

It may be that they leave more confused and frustrated than anything, but that really is the purpose of this first try. They are constructing knowledge based on hypothesis and testing within the context of the scientific method and it takes time, effort and brainstorming.

The next class session begins with a question and answer session. Discuss the idea, if it comes up, that some guidelines for approaching building the model are needed. Give the groups 10 minutes to come up with some rules or guidelines to make sure everyone completed the model in a similar fashion. Be sure to remind them that the earth's surface has been mapped and therefore all of the projects should be similar and this is the point of the discussion and group guidelines designing session.

The point is not to have all of them to look exactly alike, but to follow the same guidelines in building their model. Point out that time outside of class doing some research on the internet would be helpful. Give them the rest of the time to take the current boxes and modify what they had already done.

After completing the boxes on an assigned date and bringing back to class, discuss how they can measure the differences in each box. Some of the possible ways this will happen is putting them in order from the darkest to the lightest based on color paper used. It can be a challenging process trying to get 32 5th grade students to agree on which boxes were darker but this will be the best way to organize the projects for the next part. Allow them a guided discussion period even if it takes up the rest of the time for that day. After consensus number the boxes and set them aside until the next science class.

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"Investigating the Hypothesis" is set for the following class time. First, discuss what a variable is and that we want to control as many as possible to get accurate test results. Use a demonstrated example if necessary.

Students place a thermometer in their box. Have them place it in the same location in every box so that this variable will not change and explain this variable control factor to them. Again, discuss and emphasize variables with them.

Next cover the box with the clear plastic wrap and place them in same area that faced the afternoon sun so as to control that variable as much as possible also.

Have students check their boxes at 5 minute intervals for 30 minutes and record the new temperature for each interval on a sheet of paper. Have them keep the data they took for the next class.

Give each group a sheet of graph paper with both of the axis already labeled so that we would get graphs that we could compare. This should be one of the skills they are working on in math and the scientific graphing will add relevance and reinforcement to that.

Have an example posted somewhere for the class so that all the graphs look similar in design. Instruct them to make a line graph with each of the six points. Agree on a starting temperature for the graphs so that there will be a common first point on all the line graphs.

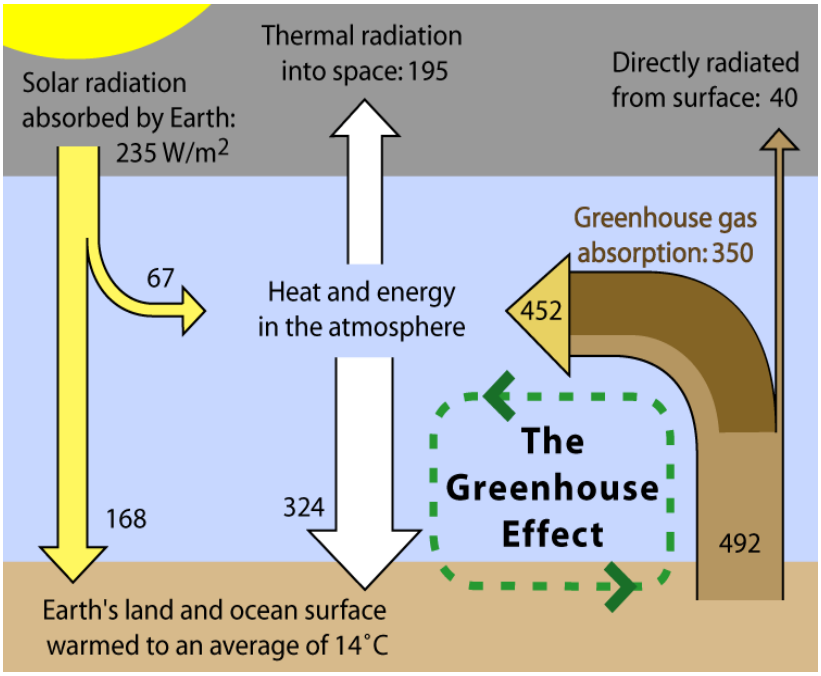

Image created by Robert A. Rohde / Global Warming Art

The graphs are posted above each box and do a museum walk where each of the students walk around to each box, look at it, and discuss with their partner any interesting information gained or observations they made.

Compare the order of light to dark boxes to the temperature graphs for each one. For the most part the students will be

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pretty accurate in the ordering of the boxes. Have them look at the data collected and tell them to determine if there are any trends that they can see based on the graphs.

Students return back to their original groups and take out the hypothesis they had come up to begin with. Have each group share their hypothesis and whether it was correct or not based on the evidence we had collected.

For "incorrect" hypotheses discuss how scientists use an incorrect hypothesis and conclusions drawn from the experiment conducted to help them guide their next hypothesis and experiment.

Finally, the overarching questions can be addressed: 1) How did building this model help us better understand global warming? 2) How can we use the data to change the earth's surface? Don't give them an answer but allow them this as a take home assignment to complete. Each question is given with an expectation of a 4-5 sentence response.

Differentiated Instruction

One of the ways to differentiate instruction is to select the partners for the students during the experiment. Make a conscience effort to pair up a stronger science student with one that is not as confident. Fall back into a whole class exercise by having the students take out their highlighters and highlight the answers the class is looking for. The students who answer the questions have to refer back to the reading and tell in what paragraph they found the answer. Then highlight the answer and write complete sentence answers into science journals. Make use of the overhead to make sure everyone was on the correct track when answering the questions. If available one-on-one time with students who are struggling is ideal.

In the computer lab the students are able to work at their own pace in watching the videos and answering the questions. They are not able to move forward or complete a lesson until all the questions are answered correctly. If students are able to finish before the struggling ones complete their work, give them another activity to complete about global warming on the computer.

Those students who were given individual or small group instruction may do better and feel more successful just from the fact they will not be afraid to share their answers in a small group. Also, pairing the students according to some criterion, allows the students a chance to step back and watch yet still participate. Intervene with groups if one student wants to do all the work and the lower academic student does little and give specific tasks to these people. In addition, do your best to match students with various strengths like a strong science person with a strong math person.

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Assessment Strategies

They receive a grade for participation on the building of the model and the line graph they create. The activities graded range from in class work, take home, and partner activities. The activities composed of paragraph writing, short answer, true/false, fill in the blank, and multiple choice questions are graded accordingly. The assessments include drawing and explaining their pictures, video lessons, and reading of materials that were age appropriate. An activity that the entire class goes through together is not given a grade.

Fifth and sixth graders are going to have an easier time when it comes to fill in the blanks, true/false, and even short answer. Give credit for the drawings and explanations of what each one meant. Assess whether they understand the four steps and could they put the information in their own words rather than just regurgitating information given to them, i.e., being able to explain it in their own words.

Additional Information for the Activity

The preparation for this unit take a great deal more thought time than for other science activities. It is not just open the book to a certain page and look up the vocabulary words! Gathering materials, especially trying to get enough pizza boxes, can be a challenge. You may have to order the pizza boxes online so plan in advance. One of the goals is presenting the material differently so that the students are encouraged to find out for themselves as much as possible. You will have to guide them through some unfamiliar terms and concepts but for the most part get them to find out based on what they did, not on what they were told. Remember that everything we know about science was discovered in exactly this fashion.

A concern is that with too much liberty classroom management will suffer. It is easier to keep them on task that you might think, especially when they are deciding on questions for themselves. For the most part they will want to be left alone to explore and an inquiry-style activity like this one is very good for that.

You are practicing a change in approach to teaching science that gives the students all an equal voice when it comes to designing hypotheses and looking at data. There was no right or wrong way to build the box which allows the students a chance to be creative without the fear of failure. Also, since they know that their hypothesis could be right or wrong without a negative effect, it allows them to take more chances in trying to explain the results gained from the model. Instead of trying to make the data fit the answer, they are able to say the data did not match the hypothesis and that more testing would need to be done to try and come up with a correct hypothesis.

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Conclusion

The students gain so much more from this way of teaching. The idea, especially at the elementary level, is not to totally do away with the worksheets, rather incorporate them in throughout the lesson using inquiry methodology as much as possible along with the hands on activities. Having student this focused on the nature of science and the inquiry methods gives science-appropriate results since there is scientific truth in this approach.

Please share your comments about successes with this method with Chad Fawley, c/o Pleasant Valley Elementary School, 405 Surrey Drive, Reno, Nevada 89511, 775-849-2761 or by e-mail: Chad Fawley < cfawley@washoeschools.net>

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