Microclimate Lesson Plan

Lesson Title: Examining learning microclimates

Intended Learning Objectives:

Students will:

- Map the temperatures around the room and to create and isothermal graph.
- Use the temperature sensor to explore how temperature varies in the classroom
- Critique the use of energy in their school using temperature and climate control as a measure of that effective/ineffective use.
- Import images from your cameras to construct an iPhoto book to explain the use of energy to control climate in contrast to other areas of the world.

CA STANDARD:

- Use numerical data in describing and comparing objects, events and measurements.
- Collect data in an investigation and analyze them to develop a logical conclusion.
- Predict the outcome of a simple investigation, and compare the result to the prediction.
- How to use weather maps and weather forecasts to predict local weather, and that prediction depends on many changing variables.

NATIONAL SCIENCE EDUCATION STANDARDS: CONTENT

- Solar energy reaches Earth through radiation, mostly in the form of visible light.
- Humans have a major effect on other species. For example, the influence of humans on other organisms occurs through land use — which decreases space available to other species — and pollution — which changes the chemical composition of air, soil, and water.
- Humans use many natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.
- The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.

NATIONAL SCIENCE EDUCATION STANDARDS: PROCESS SKILLS

- Formulate and justify predictions based on cause-and-effect relationships.
- Construct and interpret graphs from measurements.
- Develop a testable question and draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.
- Plan and conduct a simple investigation based on a student-developed question and write instruction others can follow to carry out the procedure.
- Recognize and respond to student diversity and encourage all students to participate fully in science learning.
- Enable students to have a significant voice in decisions about the content and context of their work and require students to take responsibility for the learning of all members of the community.
- Nurture collaboration among students and structure and facilitate ongoing formal and informal discussion based on a shared understanding of rules of scientific discourse.
- Create a setting for student work that is flexible and supportive of science inquiry.
- Engage students in designing the learning environment.
- Identify and use resources outside the school.
- Make the available science tools, materials, media, and technological resources accessible to students.
- Structure the time available so that students are able to engage in extended investigations.

Microclimate Lesson Timeline

Time	Lesson Content	Materials/ Equip.	Ref.
10 min	I. Orientation, Introduction or Tie-in • Who is hot in this room? • How much does it cost to cool the room? II. Demonstrate the use of the tool • How do we measure temperature? III. Instructions, Outcomes, and Grouping	Temp Probe Demo set	
30 min 20 min	IV. Data Collection • Assigned zones and roles o Computer operator o Facilitator/Recorder o Probe operator • Collect temperatures • Report temperatures to Tr computer • Collect compiled data V. Data Analysis • Create isotherm • Discuss plot and room characteristics VI. Application Questions	10 Logger Pros 10 Temp probes 10 iBooks Digital Camera Handout #1 Handout #2	
30 min	VII. Extension Project • Choices of iPhoto book, Creative writing on efficiency or environmental impact, or School assessment or plan for spending.	iBooks, iPhoto or Keynote	

Student handout #1 Name:_____

CEILING ISOTHERM
(Front of Room)

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

Instructions:

1. Use the temperature probes for measuring the temperature in your zone (tens, twenties, thirties, etc.). Measure the ceiling temperature.
2. Fill in the table for your measured temperatures
3. Report your temperatures to the teacher chart at the front of the room
4. Copy your peers' temperatures into the table
5. Repeat steps #1-4 for the floor temperature on the separate FLOOR ISOTHERM chart.
6. Connect the numbers that are the same with similar colors
7. Make legend for your Isothermal graph.
8. Answer the Application Questions.

Application Questions:

9. Where was the temperature in the room the hottest? Coldest?
10. Where in the room was there an isolated temperature?
11. Can you explain using features of the room (windows, air vents, doors, water pipes) the differences in temperatures throughout the room?
12. What is the difference in the floor and ceiling temperatures?
13. How would this activity be different if the air conditioners were not on?
14. Think about the time and temperature and conditions during the time you collected the data. Is the school being efficient with it's heating/cooling procedures? Are there suggestions you would make for not wasting energy?
15. List at least three sources of where does electricity is produced. Next, discuss with your group how increasing the use of electricity would impact the environment in negative ways.

Student handout #2 Name:_____

FLOOR ISOTHERM
(Front of Room)

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

Student Projects

1. One culminating assignment can be to create an iPhoto book to show to other students their answer to the question, "How do United States taxpayers spend their precious educational funds on climate control?" Students' iPhoto book should include the following:
   - The statement of the problem
   - The procedures they used to study the issue
   - Description of what evidence exists to demonstrate the local issue
   - Photos and graphs which analyze the data.
   - How accurately their answer may be.
   - How does this model fits other contexts
   - What evidence is available to show we are right.
   - What advice we would give an inquiring government seeking counsel on how to best spend educational resources
2. Another could be to write a creative story about what learning would be like in a less comfortable non-climate controlled environment (e.g.; desert, jungle, mountainous region, remote South American mission orphanage). Be sure to be specific as you write a short creative story about life in school and how schools in America waste resources. Imagine living in a country which has limited energy and resources. How would learning be different if no temperature control was used?
3. Finally a student can write a plan for your school district to propose an energy conservation model for heating and cooling your school. Include how much money you would save and exactly where you think the money would be spent that is saved