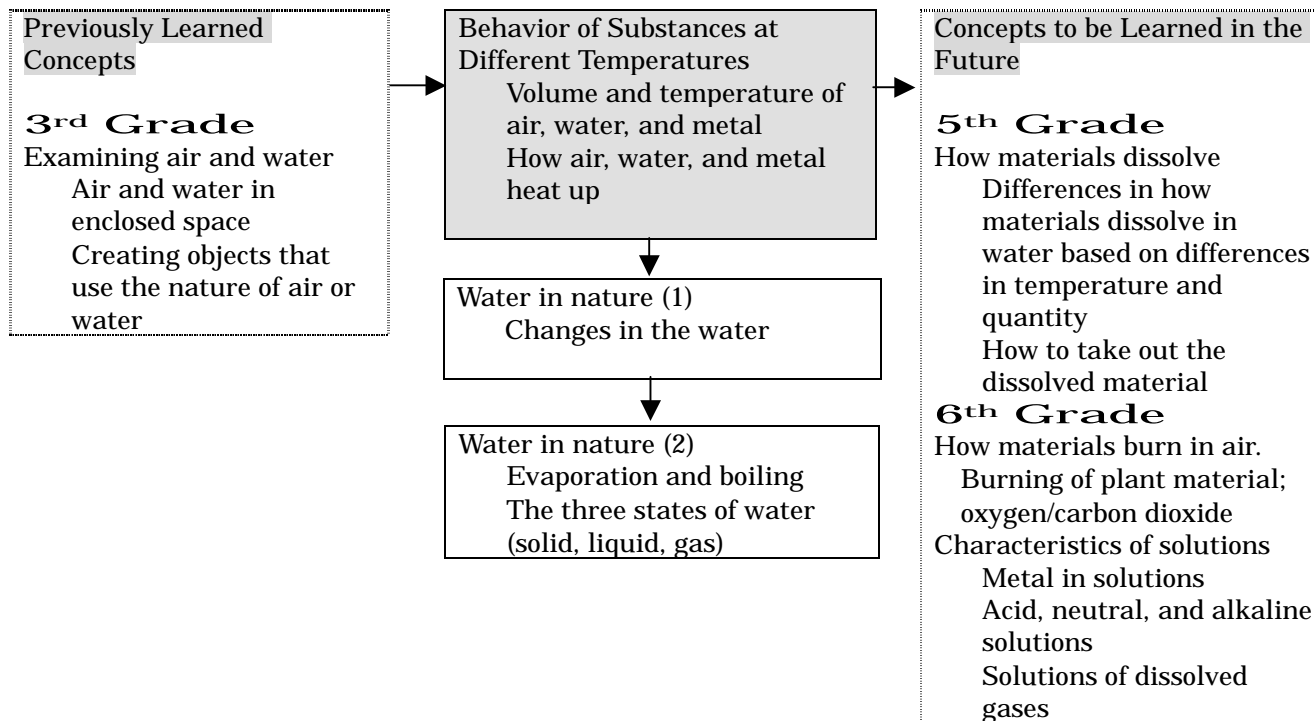


4th Grade, Class A Science Lesson Plan

November 14, 2000 (Tuesday)
 2nd Period Science Lab. #1
 Instructor: Isao Hirano
 Number of Students: 20

1. Name of the Unit: Behavior of Substances at Different Temperatures

2. Relationship of the Unit to the Curriculum



3. Instructional Plan

Behavior of Substances at Different Temperatures (Total: 12 lessons)

- Volume of air at different temperatures 2 lessons
- Volume of water at different temperatures 2 lessons
- Volume of metal at different temperatures 2 lessons
- How materials heat up 5 lessons
 - How metal and water heat up
 - How metal heats up
 - How water heats up
 - How water heats up (this lesson)
 - How air heats up
- Conclusion 1 lesson

4. Instruction of this Lesson

(1) Title: How Water Heats Up

(2) Goal

Be able to verify the students' initial prediction of how water will heat up through experimentation.

Be able to investigate how water heats up, and to notice that the heated water is moving.
Be able to think about the differences between how metal and water heat up.

(3) Relationship of the Lesson to the Goal of Science Education at the School

Science Education Goal:

“Not only to rear students’ minds to autonomously connect with surrounding nature and to love nature, but also to foster ability to investigate problems in nature scientifically.”

There are many students who have had the experience of heating up something through cooking in everyday life. However, I think many of them have not thought out the relationship between material and temperature. Therefore, the During the first half of this unit, students learned about the volume change in air, water, and metal that are associated with changing temperature, and learned that the changes are different among these three materials. During the second half of this unit, the students will learn how different materials heat up differently.

My students have been experiencing many activities that are oriented toward identifying problems autonomously, establishing hypotheses, and testing them by developing their own experimental methods. I believe that students can develop problem-solving abilities through these activities.

Last week, my students studied how metal, that they find in their surroundings, heats up. In this lesson, the students will investigate objectively how water heats up by thinking out their own experimental methods. Then they will compare their findings with their findings with metal. I like to make the most of students’ ideas, and support them, in order for them to be able to solve the problem on their own.

(4) Learning Process (How water heats up : a lesson before this lesson)

Steps (min.)	Activity of the Students	Teacher's Support and Points to Remember	Evaluation View Point
Intro- duction (5)	<p>Recalling what they did previously</p> <p>When we warmed up water in a test tube, it was warm at the upper part of it. Why it was like that?</p>	<ul style="list-style-type: none"> Ask the students to recall their experiment during the previous lesson and encourage their interest in further investigation. 	<p>Were the students able to recall what they learned previously?</p>
Develop- ment (35)	<p>Grasping the problem</p> <p>Let's investigate in detail how the water heats up!</p> <p>Predictions about the problem</p> <ul style="list-style-type: none"> Predicting it individually Write down their prediction on their worksheets <p>* Anticipated students' reaction:</p> <p>Just like the metal, it will heat up first closest to the fire.</p> <p>I wonder if the heated water will move upward?</p> <p>Discussing as a group how to solve the problem</p> <p>* Anticipated students' ideas</p> <p>What would happen if we put something light in the water and then heat it up?</p> <p>What would happen if we put in some honey?</p> <p>It might be useful if we had water that changes its color according to its temperature.</p>	<ul style="list-style-type: none"> Ask students to predict how the water will heat up by asking them to recall the experiment of heating up water in a test tube. Prepare a worksheet that helps students express their ideas in words and pictures. Make sure to allocate enough time for this section in order for the students to propose many ideas. Prepare experimental tools and worksheets so that the students can design experimental devices based on their individual ideas. 	<p>Were the students able to propose their own ideas about the problem?</p> <p>Were the students able to think of ways to solving the problem?</p> <p>Were the students able to design experimental devices for use in the next lesson?</p>
Conclu- sion (5)	<p>Each group presents their idea for how to actually conduct the experiment during the next lesson.</p>	<ul style="list-style-type: none"> Help them to clarify what they are going to use for what purpose. 	<p>Were the students able to present their ideas for the experiment that will be conducting during the next lesson clearly?</p>

<p>Development #2 (20)</p>	<p>Discussing the results of the experiments</p> <ul style="list-style-type: none"> Presenting the results of the experiments <p>(An example of one student's observation on water movement)</p> <p>The miso (or sawdust) moved upward when we heated the water.</p> <p>The water changed its color to blue and moved upward. But it also moved downward again.</p>	<ul style="list-style-type: none"> Ask a representative of each group to present the results of their experiments. 	<p>Were the students able to present their experimental results accurately?</p>
	<ul style="list-style-type: none"> Organizing the contents of the presentation on how the water heated up based on the results of the experiments <p>(An example of how the student think the way the water heats up)</p> <ul style="list-style-type: none"> The heated up water moves upward. The cold water on the top moves downward by the water pushing from the bottom the beaker. 	<ul style="list-style-type: none"> The teacher orchestrate and organize the students' ideas. Give some support to the students in order for them to think about how water heats up by comparing it with the case of metal. <p>In the case of metal, heat moves from the point where it was heated to the further points gradually.</p> <p>In the case of water, the heated water moves upward and the cold water moves downward. This cycle goes over and over and the whole water gradually heats up.</p>	<p>Were the students able to think how water heats up by comparing it with the case of metal?</p>
<p>Conclusion (3)</p>	<p>Summarize what you learned and what you thought about the lesson, on the worksheet.</p>	<ul style="list-style-type: none"> I like to ask the students to summarize their thoughts on the lesson at the end of every lesson. By doing so, I can learn more about the students' understanding and their interest. 	<p>Were the students able to reflect on and summarize this lesson?</p>

(5) Evaluation

Were the students able to conduct the experiments safely by cooperating with friends and using the tools properly? (interest, desire, & attitude), (skills & expression)

Were the students able to describe how the water heats up in their own words? (expression)

Were the students able to understand how water heats up and to compare with the case of metal? (understanding), (thinking)