Mathematics Lesson Plan

For the lesson on Monday and Wednesday, August 6 & 8, 2001
At Turnbull and Brewer Island Schools, San Mateo, CA
Grade 4
Instructor: Hiroko Uchino
Tad Watanabe

1. Title of the Lesson: Which chocolate is the biggest?

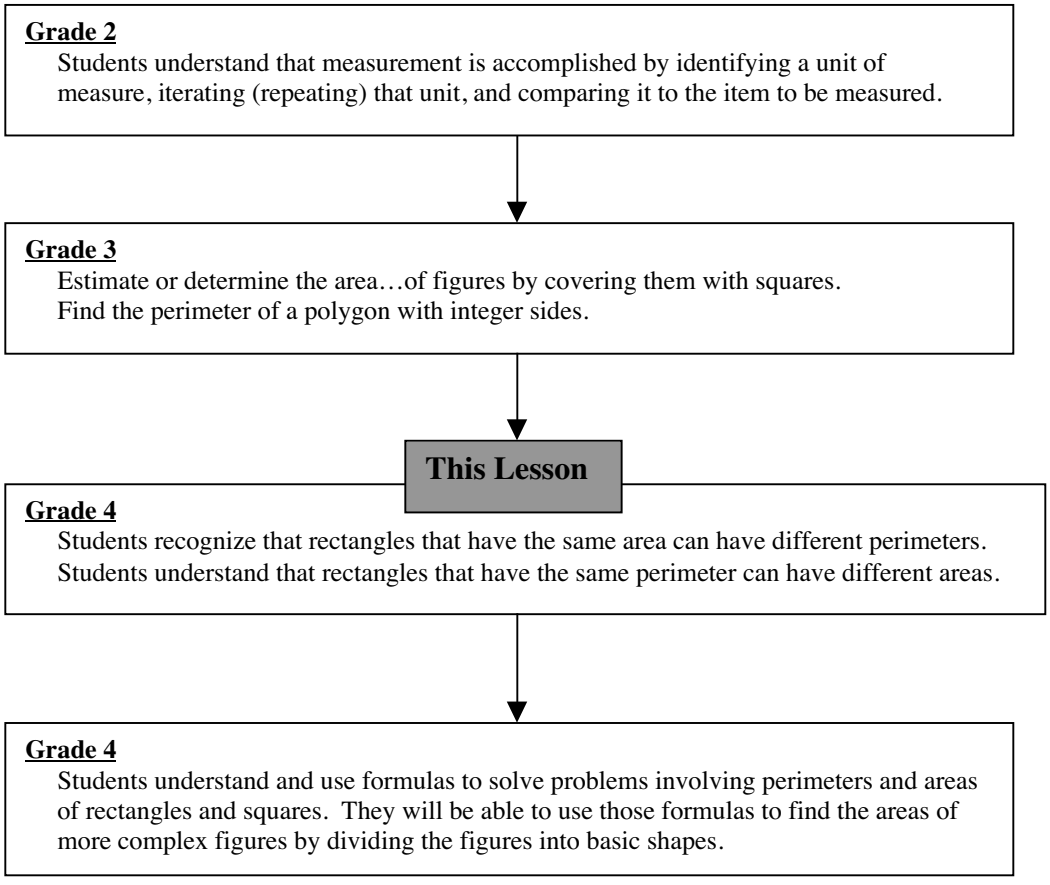
[When the area of a rectangle or a square is the biggest, is its perimeter also the longest?]

2. Goals of this lesson:

Students will:

a. Choose the biggest figure and explain why it is the biggest.
b. Participate in the activities and have their own approaches to solve the problem.
c. Discuss and share their own ideas and opinions with each other.
d. Realize and understand that bigger area does not necessarily mean longer perimeter and vice versa.
e. Feel motivated to study the next lesson.

3. Relationship of the Lesson to the Mathematics Content Standards for California Public Schools K-Grade12.



Grade 5
Students will derive and use the formula for the area of a triangle and a parallelogram by comparing it with the formula for the area of a rectangle.

4. Instruction of the lesson

In grade 3, students learned how to measure the areas of rectangles and squares by covering them with unit squares. They also learned how to measure perimeters of various polygons with integer sides.

In grade 4, one of the goals of studying geometry is to understand the concepts of area and perimeter of rectangles and squares, and how to calculate them using formulas.

The California Standards list four specific subgoals:

(1) Measure the area of rectangular shapes using appropriate units, such as cm^2, m^2, km^2.
(2) Recognize that rectangles that have the same area can have the different perimeters.
(3) Understand that the rectangles that have the same perimeter can have different areas.
(4) Understand and use formulas to calculate the area and perimeter of rectangles and squares….

In this lesson, we are going to focus on (2) and (3).

In general, students have a tendency to think that if rectangles have the same area, their perimeters are the same, which is not true. So in this lesson, we are going to focus on this misconception and provide "brainstorming" activities and discussion, expecting that this lesson will help students improve their mathematical understanding and reasoning skill.

5. About the students:

This lesson is set up for the Lesson Study Workshop. So we really don't know a great deal about the students. So before we planned the lesson, we tried to find out as much as we could about not only the curriculum and the content that students have already learned, but also about students' attitudes and background.

We have learned that most students have learned math successfully, and have not faced major problems. They generally have a positive attitude toward learning. So we have decided to offer the following open-ended problem as a mathematical problem solving activity:

" Which chocolate do you choose and why do you choose it?"

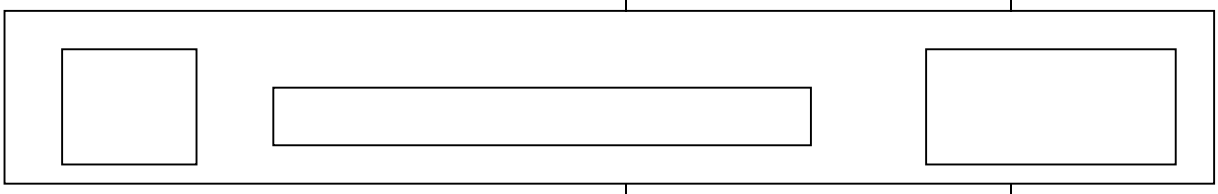
To motivate students to work on the activities, we are going to show three rectangles and a square as if they are chocolates, and set up the situation as if they can obtain one of these. However, the areas of these figures cannot be compared easily because their shapes and sizes are different as follows:

Chocolate	Length	Width	Area	Perimeter
A	8	8	64	32
B	6	10	60	32
C	3	18	54	42
D	2	14	28	32

So students have to make various conjectures and try various things, such as measuring the perimeters or areas of the chocolates. We expect that they will have their own approaches, and share them, then have a discussion in the classroom.

6. Learning Process

Students' Learning Activities, Teacher's Questions and Expected Reactions of Students	Teacher's Support	Points of Evaluation
Introduction to the Problem Today's problem Our friend Tony is going to have a birthday soon. So we went to the shop to buy a birthday present. We found the four kinds of chocolate bars in the store. We wanted to buy the biggest one because he likes chocolate so much. But we couldn't decide which on is the biggest. We even tried to overlap them, but still we were not Q1: How do you think we can find the size of these chocolates? Q2: How can we compare these? Q3: Is there any way to express these sizes of figures in numbers? S1: We could compare by measuring the perimeters. S2: We could compare by measuring the areas. S3: We could compare by putting each side together.	Check if anyone does not understand questions. We are not going to use the way of overlapping to focus on the area and perimeter more. So we will mention as we have already tried it before. Bring up all the questions and write down what students brought out on the paper.	Did more than three ways of finding out the size of figures come up into the discussion?



2. Recognizing today's main question Q4. How can you find out the area? S1: placing 1 x 1 squares inside of figures and count them. Q5. So if the area is the biggest, is that one biggest? S: Yes Q6. But how about compare the perimeters. Counting the squares inside of the figures would be troublesome. However, if you just measure the length around the figure, the longest one might be the biggest. S1: Yes S2: Maybe **Q7. So if the area of a figure is the biggest, is its perimeter the longest? (the main question)** S1: Right. It's related to each other. S2: The bigger the area, the longer the perimeter. Let's investigate this question in your groups by measuring the areas and perimeters of the shapes we will give you.	Be careful that at least perimeters and areas should be on the blackboard. If not, we will bring it up in class discussion. Hiroko is going to approach the area and Tad is going to approach the perimeter in the discussion. Place the set on the white board.	Did all the students participate the discussion? Did students recognize today's main question?
3. Group work: measuring , discussing and proving (1) Make groups and have them discuss in their groups how to compare the figures. (2) Measure the perimeters and areas with their own approaches. (3) Write down their own solutions and what they have found out on the big paper	Divide students into some groups with 3-4 people. Provide the follow items: the same sizes of figures to all groups, markers, rulers, scissors, 1x1 grid sheets, big white papers Help and assist their activities	Did they write it down successfully. Did students have a good discussion and activities in each group?
4. Comparing and Discussing (1) Post their big papers and explain what they did and what they found out in their group activities. (2) Ask each other any questions and try to make sense of the findings. (3) Bring up any doubts.	Encourage students to express their opinions. Facilitate students' discussion and encourage them to ask questions.	Did students try to listen to and understand each other? Did they try to solve the problem through the discussion?

5. Find the solution to the problem Understand that the areas of the rectangles or squares do not always increase as the perimeters increase and vice versa.	Write down each figure's area and perimeter under each figure clearly to summarize the solution, and review what students learned through the lesson.	Did all the students make sense of this?
6. Summing up (1) Review what students learned through the lesson. (2) Have them write in a journal what they learned through the lesson.	Hiroko: Now I understand which one is the biggest chocolate I should buy for Tony. Tad: Now I understand that we can't use perimeters to decide which one is the biggest.	

7. Evaluation:

a. Were the students able to choose the figure they wanted, and provide at least one (or more) reasons for that?
b. Did they participate in the activities and develop their own approach to solving the problem?
c. Did they discuss and share their own ideas and opinions with each other?
d. Did they understand that bigger area does not necessarily mean longer perimeter and vice versa?
e. Did they develop personal motivation to study the next lesson?