

4th Grade Mathematics Lesson Plan

Research Theme	To cultivate students' ability to express themselves logically: Developing lessons that incorporate activities that promote explaining and retaining
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1. Title: Perimeter and Area

2. About the Research Theme:

In the 4th grade lessons on area, students learn the formulas for the areas of rectangles and squares after studying direct and indirect comparison and numeration of quantities by using arbitrary or standard units. After learning the formulas, many lessons are devoted to exercises that involve using the formula. These routine exercises are generally helpful to confirm students' proficiency in the mechanics and "superficial" aspects of this topic.

However, if lesson activities are solely devoted to mere exercises, students will have no time to enjoy intellectual exploration.

This lesson, using area as the topic, is intended to encourage students to enjoy logical thinking and explanation of their ideas to each other. In mathematics, expressive ability -- being able to explain "Why is it like this?" -- is important. Hence, it is necessary to provide multiple opportunities in the classroom for students to practice explaining their ideas to each other. Routine exercise of practicing explaining ideas is just as important to cultivate student ability to express as it is to improve their calculation skills.

This lesson starts by showing five shapes that have same area to the students and then asking them, "Which shape has the longest perimeter?"

The shapes are composed of four squares and are the same shapes as in a game called "Tetris" that students are familiar with. Interestingly, four shapes out of the five have equal perimeters. Only the square has a shorter perimeter.

Why does the perimeter become shorter only for the square while all the other shapes share perimeters of the same length? Having students explain the answer to this question is the goal of this lesson. Lessons about area usually deal with a simple explanation of the fact that areas of shapes cannot be measured by comparing their perimeters. This lesson encourages students to look at the change in perimeters in accordance with the transformation of the shapes.

Throughout the activities, students are required to listen to others carefully and explain the process of their ideas step by step by handling or manipulating the shapes. I believe these activities are very important. Many teachers are now talking about the PISA reading method and are tempted

to use the thick textbook that is suggested with its tables and charts. But the most important method to cultivate students' abilities lies in basic classroom activities where students exchange their ideas with each other.

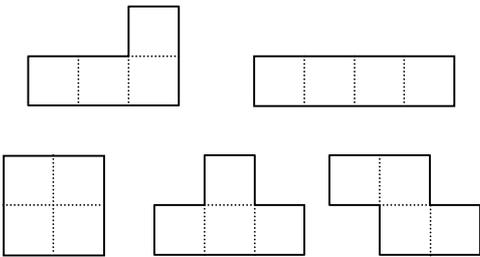
The cultivation of "practical expressive ability" is achieved by motivating students to pay conscious attention to their "explanation activity" especially in regards to how well the other students understand their explanations. Students can learn to become aware of listeners' reactions and can themselves become good listeners that are able to process information and appreciate the intentions of others.

3. Plan of the Lesson

(1) Goal of the Lesson

To logically explain to their friends the rules for shapes with equal perimeters by engaging in activities that investigate perimeters of shapes that are composed of four squares.

(2) Process of the Lesson

Learning Activities	Teacher Support
<p>1. Which shape has the longest perimeter?</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>There are five shapes that have equal areas. Which one has the longest perimeter?</p> </div>  <p>Post the five shapes from the game Tetris, but do not tell students that they are composed of four squares at first.</p> <ul style="list-style-type: none"> • If the areas are all equal, the perimeters should all be equal too. • No, they seem to be different. • But some shapes obviously seem to have equal perimeters. 	<ul style="list-style-type: none"> • Do not remind students of the Tetris shapes at first. Have students speculate using their instincts. • After hearing students' speculations, tell them that these shapes are composed of four squares • Students learned in previous lessons that there are various shapes that have equal areas. They drew many shapes with equal areas in their notebooks. These experiences help form a base for thinking. • Some students might think that the long one has the longest perimeter. Others might think that they all have equal perimeters due to their equal areas. Give students a chance to change their speculations based on their own intuition.

<p>2. Let's explain why the perimeters are equal.</p> <ul style="list-style-type: none">• Explain using the shape.• Repeat the explanation part by part.• Explain moving the shape.• Have pairs of students explain to each other. <p>3. Why does the square have the shortest perimeter?</p> <ul style="list-style-type: none">• Because it has more hidden sides.• Marking the exposed lines would be a good idea.	<ul style="list-style-type: none">• Have students explain by using the shapes without actually measuring.• It is important here to have students explain articulately enough to convey their reasoning. By having frequent discussion activities, individual students get used to explaining their ideas.• If there are some students who have taken a close look at the square, lead the class in a discussion about why only the square has a shorter perimeter.
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