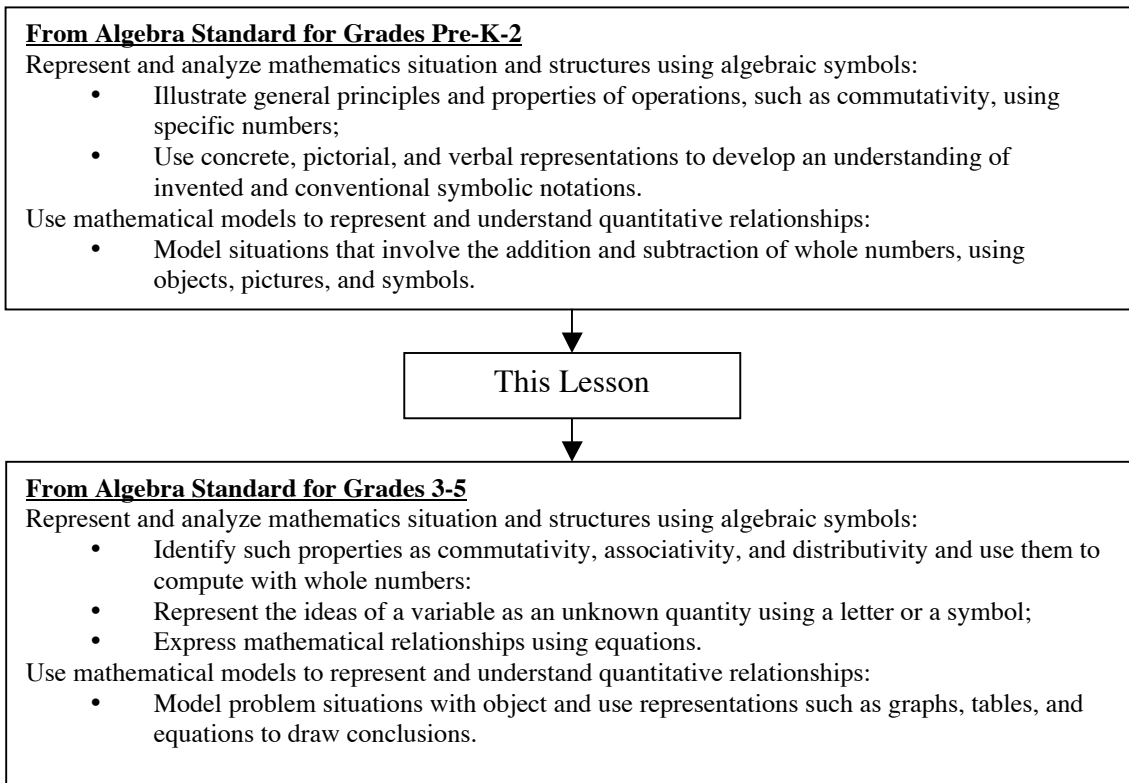


Mathematics Lesson Plan for Grade Three

For the lesson on Thursday, October 3, 2002
At the Meadow Heights Elementary School, San Mateo, CA
Instructor: Akihiko Takahashi

1. Title of the Lesson: Representing relationships with equations
2. Goal:
 - a. Deepen students' understanding of numbers, ways of representing numbers, and relationships among numbers.
 - b. Deepen students' understanding of equation to represent quantitative relationships.
 - c. Provide students with opportunities to find an importance of working with their peers to deepen their understanding of mathematic.
3. Relationship of the Lesson in the Principles and Standards for School Mathematics (NCTM, 2000).



4. Instruction of the Lesson

The main activities of algebra for elementary school mathematics can be categorized into following two kinds of activities by using two aspects of algebra (National Research Council, 2001).

- (a) Representational activities of algebra:
algebra as a systematic way to expressing generality and abstraction, including algebra as generalized arithmetic
- (b) Transformational or rule-based activities of algebra:
algebra as syntactically guided transformation of symbols

This lesson is designed to provide students with an opportunity to experience representational activities of algebra in order to help them deepen their understanding of equation.

Typical representational activities of algebra often involve translating verbal information into symbolic expression and equations. For example, students are asked to generate an equation(s) to represent a quantitative problem situation with an unknown quantity. This problem situation is usually presented as a story problem. Through various activities such as solving story problems, students are expected to develop their understanding of equation as a way to express quantitative relationships. Since students have had opportunities to solve story problems involving basic addition and subtraction in grade K - 2, it is expected that they will be able to express simple quantitative relationships using an equation.

Although students in Grade K - 2 are introduced to the basic concept of algebra, expressing simple mathematical relationships in a systematic way, most students do not pay much attention to the importance of generating an equation(s) to represent quantitative problem situation and often focus only on using the equation(s) to find missing numbers (unknown quantity). In fact, a common explanation for the equation sign given by the students is that “the answer is coming” (NCTM, 2000). Since the concept of equality is one of the basics of the algebraic concepts, students need to recognize the equal sign as a key component of equation to express mathematical relationship.

To help students recognize generating an equation as a way to express quantitative relationships, this lesson employs a representational activity using Cuisenaire Rods.

Cuisenaire Rods were invented as a manipulative to help students understand abstract concepts of mathematics in concrete ways. The activity for this lesson is based on the activity included in a German mathematics textbook, *Mathematik in der Grundschule* (Fricke, V. & Besuden, H., 1984). This German textbook consists of a variety of activities using various manipulatives to help students understand abstract concepts. One uniqueness of this textbook is that an equation with a missing quantity, even an equation with several missing quantities, is introduced in the first grade before story problems are introduced. By using a picture, Cuisenaire Rods, and an equation, the textbook facilitates students by providing opportunities to express quantitative relationships using equations.

After referring to the activities of German textbook, the activity for this lesson was designed to facilitate students understanding by providing them with the opportunity to express quantitative relationships among Cuisenaire Rods using equations. For the grade 1 lesson in *Navigating through algebra in grades prekindergarten-grade 2* (NCTM, 2001), the activity for the lesson is designed to connect students’ previous knowledge of addition, subtraction, and multiplication, as well as extending their learning to algebraic thinking, which students are going to learn in grade 3.

Preceding to this lesson, students will have spent about one-half hour engaging in an activity to know and familiarize themselves to Cuisenaire Rods. With this activity students will notice various relationships among different Cuisenaire Rods.

<p>3. Comparing and Discussing</p> <p>(1) By looking at various equations, students are expected to notice some equations consist of the same numbers with a different order. Commutativity Example: $10=3+7$ and $10=7+3$</p> <p>(2) By looking at various equations, students are expected to notice some equations include same number(s). Associativity Example: $10=2+2+6$ and $10=4+6$</p>	<p>Help students to examine equations not only by looking at numbers and symbols of equations but also relationships among Cuisenaire Rods in order to make strong connection between symbolic representation and concrete representation.</p>	<p>Can students see equation as a way to express quantitative relationships?</p>
<p>5. Summing up</p> <p>(1) Using the writing on the blackboard, review what students learned through the lesson.</p> <p>(2) Ask Students to write a journal entry of what they learned through the lesson.</p>		

6. Evaluation

- a. Were the students able to find several ways to express quantitative relationships by using Cuisenaire Rod?
- b. . Were the students able to find several ways to express quantitative relationships by using equations?
- c. Were students able to review what they learned during the lesson and write about it in their journal?

References

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