Mathematics Lesson Plan for 5th Grade

For the lesson on September 21, 2006
At NCTM Regional Conference, Miss Kowieski's class
Instructor: Miss Jen Kowieski
Lesson plan developed by: Jen Kowieski, Heather Brown, Laura Kaplan, Kathy Root, Gina Carroll

1. Title of the Lesson: Students' Strides

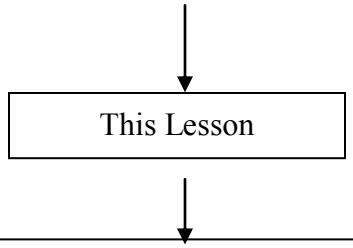
2. Goal of the Lesson:
   i. Students will compare decimal values.
   ii. Students will apply their understanding of place value of tenths and hundredths.

3. Relationship of the Lesson in NCTM Standards and Expectations

Students should be able to understand numbers, ways of representing numbers, relationships among numbers, and number systems.
Students should be able to understand the place-value structure of the base-ten number system and be able to represent and compare whole numbers and decimals. Students should be able to recognize equivalent representations for the same number and generate them by decomposing and composing numbers. **Students should be able to compute fluently and make reasonable estimates.**
Students should be able to use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals.

Relationship of the Lesson in the Illinois Learning Standards for Mathematics.

6.A. Demonstrate knowledge and use of numbers and their representations in a broad range of theoretical and practical settings.
6.A.2 Compare and order whole numbers, fractions and decimals using concrete materials, drawings and mathematical symbols.
6.B. Investigate, represent and solve problems using number facts, operations (addition, subtraction, multiplication, division) and their properties, algorithms and relationships.
6.B.2 Solve one- and two-step problems involving whole numbers, fractions and decimals using addition, subtraction, multiplication and division.



6.A. Demonstrate knowledge and use of numbers and their representations in a broad range of theoretical and practical settings.
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4. Instruction of the Lesson

Many elementary grade math texts begin with a unit on place value. And rightly so, for "place value is an essential foundation concept, which students must understand before they learn the basic operations of multidigit addition, subtraction, multiplication, and division. (Nagel and Swingen, 1998). However, research suggests that elementary grade students struggle with the meaning of places, regrouping in addition and subtraction, naming decimals, and calculating with decimal values (Gluck, 1991; Nagel and Swingen, 1998, other citations)

Exploring place value in depth and allowing students the opportunity to progress from work with concrete manipulatives to abstract ideas is essential (Kari and Anderson, 2003; Gluck, 1991). In this lesson, we want students to explore the decimal places of tenths and hundredths. Prior to this unit, the only experience the students have had with decimal places in math class is with money amounts involving cents. While it is valuable for students to learn that cents are parts of one dollar, the topic of money does not allow students to take their understanding of cents and generalize it to other situations involving decimals. First, we use different language for money values than we use for other decimal values. Second, there are always two places after the decimal point in money amounts, but an infinite number of possible places after the decimal point in other decimal values. Because there are always two places after the decimal point in money amounts, there is much less room for student misunderstandings in addition, subtraction, and comparison of these amounts. However, when faced with problems that include a decimal value with only a tenths place, such as 4.5, and a second decimal value with a tenths place and a hundredths place, such as 4.32, students must apply a well-developed understanding of place value in finding the correct sum.

Therefore, in this lesson, one of our goals was to push students' understanding of decimal place value beyond dollars and cents. In considering authentic situations in which ten-year olds would encounter decimal values, we looked to measurements. At first, we discussed a posing problem in which students would rank finishing times of competitors in a race. However, one great disadvantage of using measurements of time is that time is not based on units of ten (i.e. one minute = sixty seconds). In considering other attributes we can measure, such as weight or length, we agreed that we must use the metric system as opposed to the standard system. The metric system is a base-ten system, whereas the standard system is not. Measurements of length or height seem ideal in this lesson. They provide for situations in which students can create a physical representation of the measurement, thereby having a concrete material with which they can explore the concept of decimal places. Furthermore, when we do measure length or height on a piece of paper, that measurement on paper doubles as a number line.

As previously mentioned, we wanted to create a posing problem in which students are comparing decimal values which have varying numbers of decimal places. However, In discussing a situation in which measured lengths or heights could be compared, we were concerned about creating a situation in which a person measured one object to the nearest tenth of a meter, a second object to the nearest hundredth of a meter, and a third object to simply the nearest whole meter. Setting up a problem like this would imply that degrees of certainty are not that important in measurement. Therefore, in the posing problem, students measured their own strides at home. Thus, they may have all used different measuring devices which would allow for different degrees of certainty.

In our discussion, we will look to extend the students' concept of "number" from just whole numbers to include decimals. Prior to this unit on decimals, the students would read the number "2.56" as "two point five six" or "two point fifty-six." A concern, then, is that students see the "2" as one quantity and the "56" as a different quantity. A related concern is that when students look at the digits in the decimal places, they will disregard what they know of decimal place value and impose whole number places and values. For example, the 5 in 2.56 would not have a value of 0.5, but 50, and the 6 would not have a value of .06, but 6.

5. Unit Overview:

Lesson One: How Many Ways to Make a One

In this lesson, students will be given the ones blocks from the base ten blocks they used while studying place value of whole numbers. They will also be given blocks representing tenths and hundredths. At first, the class will look at how a one block and tenths block are related. Then, they will look at how a tenth block and hundredths block are related.

Lesson Two: Writing Decimals

In this lesson, students will use their flip books (see appendix) to represent in standard form the values they create with their blocks. The teacher will provide instruction as how to read decimal values. If time, students will also write decimal values in word form.

Lesson Three: Students' Strides

See this lesson.

Lesson Four: Adding Decimal Values

In this lesson, students will be given a warm-up problem of adding money amounts. Then, they will be given a posing problem in which one addend has a digit in the ones place, one addend has digits in the ones and tenths places, and one addend has digits in the ones, tenths, and hundredths places. The discussion will focus on how we apply our understanding of place value in adding decimal values. For example, we will compare how different students aligned the addends and discuss reasons for aligning them a certain way.

Lesson Five: Subtracting Decimal Values

In this lesson, students will be given a warm-up problem of subtracting numbers that have the same number of decimal places. In the posing problem, they will subtract a number with digits in the ones, tenths and hundredths places from a number with digits in just the ones and tenths places.

6. Learning Process (or Plan of Lesson)

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	Teacher's Support	Points of Evaluation

1. **Introduction** Review decimal place names. Provide students with base-ten blocks and display base-ten blocks. Model a number with the blocks. Review how we name decimal values (both word and standard form). Which is larger – a tenth or a hundredth? How do you know? How many hundredths do you need to make a tenth? How many tenths do you need to make a one? One reason we study decimals – as well as whole numbers – is that we can use these numbers in every day life. What are some examples of real life situations that include decimals? Place paper on the ground. The first roll of paper will have whole meters marked (1 m, 2 m, 3 m). The second roll of paper will have tenths of meters marked. Review whole units of measurement by asking a student to walk from the zero mark to the 1 meter mark. Then, review decimal values by asking a student to walk from the zero mark to the one-tenth mark. Next, ask a student to walk from the zero mark to the 2.7 mark. Explain what a stride is. Have student volunteers come up and model a stride. Discuss the length of the stride.	Record student responses. . Provide examples if students are stuck.	Do students know how to represent decimal values using base ten blocks? Do students recall how to name decimal values? Do students understand the relationship ones, tenths, and hundredths? Do students recognize situations that include decimal values? Do students recognize that we can use decimal values in measurement? Do students understand how values have been marked on the tape? Do students understand the meaning of "stride?" Are students making use of the markings on the paper to approximate the stride?

2. Posing Problem 1 Five friends were comparing each other's stride and decided to each measure their own stride to determine whose was the longest. Abby measured hers as 1 meter, Benjamin measured his as 1.43 meters, Carlos measured his at 1.7 meters, Gianna measured hers at 15 meters, and Emmitt measured his at 1.78 meters. How do their strides compare? Order all of the students from shortest to longest stride.		

3. **Solving Problem** Students will work in groups of two or three. Anticipated Students' Solutions • Students will order the numbers $1 < 1.43 < 1.5 < 1.7 < 1.78$. • Students will order the numbers from $1 < 1.5 < 1.7 < 1.43 < 1.78$. • Students will order the numbers with 1 as the greatest. **Anticipated Students' Strategies** • Students will use base ten blocks to represent numbers and compare numbers. • Students will use base ten blocks and place value boards to represent and compare numbers. • Students will write the numbers and compare them. In writing the numbers, student will align the digits from right to left, regardless of places of the digits. • Students will write the numbers and compare them. In writing the numbers, students will align the places. Students may or may not fill in zeroes if a number does not have a digit in the tenths or hundredths place. • Students will use the paper marked with meters and tenths of meters from the introduction to the lesson to compare values.	Allow students time to work with partners in discussing the problem and working with the manipulatives. If students are struggling, the teacher will ask them if 1.05 is the same as 1.5. Ask groups to display their solutions on chart paper.	Do students consider the place of the numerals or just the numerals in ordering the strides? Do students use manipulatives to represent numbers correctly?

4. **Comparing and Discussing** Each group will share their solutions and their method for finding their solutions. Is there agreement among the groups? If not, teacher asks questions to elicit differences among the groups and reasons for the differences. Through discussion, resolve any misunderstandings. If time allows, pose Problem 2. **Problem 2** Miss Kowieski adds her stride to the group. She measures her stride, looks at the lengths of everyone else's strides and says, "Wow! I have the second longest stride." What are possible lengths of Miss Kowieski's stride? Students work in groups of two or three. Anticipated student solutions • Students will provide a number between 1.7 and 1.78. • Students will provide a number greater than 1.7 and 1.78, such as 1.8. Anticipated student strategies • Students will use the base-ten blocks to find a value between 1.7 and 1.78. • Students will use the flip charts to find a value between 1.7 and 1.78. • Students will draw a number line to find a value between 1.7 and 1.78. • Students will simply change a digit in one of the given numbers.	Teacher selects groups to present in order of increasing difficulty.	Do students use meaning of ones, tenths, and hundredths places to explain their solutions? Do students recognize that the ones place represents values greater than the tenths or hundredths? Do students apply their understanding of the tenths and hundredths places to create a number that is greater than 1.7 but less than 1.78?

5. Summing up Post Lesson Discussion: Journal "If you had to explain to a fourth grade student what decimals are, what would you say? How would you explain how to compare decimals?"		

6. Evaluation

Do students begin to understand that the place value system is not limited to whole numbers?

Are students able to apply their understanding of the place value system in the decimal places?

Appendix